Ventura County Fire Protection District
Study of RF Communications
New Fire Station 56

June 9, 2008

Motorola, Inc., Corporate Offices
1303 E. Algonquin Road, Schaumburg, IL 60196 T: (847) 576-5000

Executive Summary

Overview

Motorola conducted a Radio Frequency (RF) communications study to determine the necessity for an antenna tower at new Fire Station 56 (FS 56) and to consider available alternatives. Key operational and technical requirements were considered for the Fire Station Alerting System, VHF Radio System Talk-In, VHF Radio Repeaters and VHF Radio Base Stations (Area Command). The study considered ongoing and planned incremental enhancements, including the Fire District's Radio Communications Improvement Project, the Public Safety Microwave Network Upgrade Project, and the Public Safety Simulcast Project. RF field-testing was performed at locations throughout the FS 56 operational area and Motorola included the results in the study's analysis.

Findings

Motorola offers the following conclusions and related explanations for meeting the Fire District's communications requirements and for improving radio communications within the FS 56 operational area:

1. Motorola concluded an antenna tower at FS 56 is necessary.
   - A. The antenna tower should be a minimum height of 55 feet, with a receive antenna mounted at the top (55 feet) and four transmit antennas mounted at 32 feet.
   - B. Utilizing a monopole antenna tower would minimize the public view impacts to the extent practicable and is less damaging to the public viewshed than a lattice antenna structure or other available alternate antenna tower types would be.
   - C. An antenna height of 55 feet allows the transmit antennas to be installed above FS 56's roofline and provides the minimally acceptable vertical height separation between the transmit and receive antennas.
   - D. The minimum physical isolation between receive and transmit antennas in the recommended configuration is 15 feet vertically measured from the tip of the transmit antennas to the bottom of the receive antenna, which ensures the transmit antennas' radiation patterns are not obscured or distorted by the rooftop of FS 56 and provides for optimum receiver performance.

2. Motorola also considered alternative technologies and locations to an antenna tower at FS 56 and concluded that no less damaging alternatives were available to adequately meet the Fire District's operational and technical requirements.

   A. Rooftop mounting of the antennas at FS 56 was evaluated. This is not a feasible alternative because the necessary interference isolation between the receive and transmit antennas cannot be achieved. Rooftop mounting of antennas must rely on horizontal spacing and would require at least 350 feet of physical separation between the antennas, which is not achievable on the rooftop of new FS 56 and would induce more signal losses due to increased transmission line lengths.

   B. Locating the antenna tower on property adjacent to FS 56 was evaluated. This is not a feasible alternative because it does not meet the Fire District's operational and technical requirements, would require a change to the radio system's architecture, does not support Fire Station Alerting, does not support VHF Radio Base Stations, and offers no advantages versus a tower at FS 56 for the VHF Radio System Talk-In and VHF Radio Repeaters. A remote radio receiver site will introduce additional potential points of failure that will not support the high reliability required for Fire Station Alerting, nor will it support the operational requirements for VHF Radio Base Stations.

   C. Locating an antenna tower at the Hess Kramer Water Tank site was evaluated. This site is not a feasible alternative for Fire Station Alerting and VHF Radio Base Stations for the reasons stated in paragraph 2.B above. Even so, this site would significantly enhance coverage for VHF Radio System Talk-In and would be an excellent site for VHF Radio Repeaters.

   D. Locating an antenna tower at the Gearry Hill site was evaluated. This site is not a feasible alternative for Fire Station Alerting and VHF Radio Base Stations for the reasons stated in paragraph 2.B above. Even so, this site would significantly enhance coverage for VHF Radio System Talk-In and would be an excellent site for VHF Radio Repeaters.

E. Utilizing an existing antenna tower at the Laguna Peak site was evaluated. This site is not a feasible alternative for Fire Station Alerting and VHF Radio Base Stations for the reasons stated in paragraph 2.B above. Even so, this site would significantly enhance coverage for VHF Radio System Talk-In and would be an excellent site for VHF Radio Repeaters.

F. Mitigation (e.g., landscaping) to minimize the visual impact of a monopole antenna at FS 56 was not evaluated.

3. To obtain optimum radio system functionality for the Fire District, Motorola recommends a 55-foot antenna tower at FS 56, plus as described above, adding additional radio equipment at the Hess Kramer Water Tank, Gearry Hill and Laguna Peak sites.

4. Motorola provided the Fire District with a budgetary pricing estimate for a single project that would improve the four proposed sites (FS 56, Hess Kramer Water Tank, Gearry Hill and Laguna Peak), as shown below. The information provided in this estimate is for informational (or budgetary) purposes only and does not constitute an offer to sell or license any Motorola product. It is not binding on Motorola and Motorola makes no representations, warranties, or commitments with respect to pricing, products, or terms and conditions, which would require more information and further detailed analysis of the requirements for which this estimate is requested.

   A. At the FS 56 site the estimated cost for a 55-foot monopole antenna and radio equipment is $85,669.

   B. At the Hess Kramer Water Tank site the estimated cost for a new antenna tower, equipment shelter and radio equipment is $361,017.

   C. At the Gearry Hill site the estimated cost for radio equipment is $50,985.

   D. At the Laguna Peak site the estimated cost for radio equipment is $4,636.

   E. The estimate for other project costs (including professional services) for all four sites combined is $559,003.

5. Shown below is a map of the radio sites referenced in the FS 56 RF Communications Study.

Ventura County Fire Protection District
Study of RF Communications—New Fire Station 56
Deliverable 1—Statement of Requirements

1. Documentation of Requirements (Operational and Technical)

This document describes the operational and technical requirements associated with radio communications at the Malibu Fire Station 56 (FS 56) and within FS 56's operational area.

1.1 Overview of the Fire Station 56 Operational Area

FS 56 serves the north Malibu coast, currently from a leased site at Camp Joan Meier on Yerba Buena Road. A new FS 56 is under development, which is located closer to Pacific Coast Highway. FS 56 is staffed full time by three firefighters and houses a Pumper (Engine 56) and a brush patrol unit (Patrol 56).

The FS 56 operational area extends along the Pacific Coast Highway (California State Route 1) from Mugu Rock in Ventura County south to the Los Angeles County line. FS 56's operational area includes portions of Point Mugu State Park (including Thornhill Broome campground and Sycamore Cove State Beach) Leo Carrillo State Park and the Santa Monica Mountains National Recreation Area and the topography is winding coastline punctuated by numerous canyons with high ridgelines, steep cliffs, and coastal bluffs. A majority of emergency events and routine calls for service assigned to FS 56 occur along the Pacific Coast Highway and within the State Park areas.

The FS 56 operational area is geographically isolated from the inland County region by the Santa Monica Mountain range that parallels the coast. The Fire District's current VHF radio sites are unable to provide reliable coverage in this area due to the extreme terrain features. The geographical isolation of the FS 56 operational area makes communications difficult if not impossible and presents unique challenges during major incidents, including wildfires, flooding, earthquakes and other disasters. As part of building a new FS 56, the Fire District is committed to improving communications within this area to the point that portable radios can support reliable communications.

1.2 Operational Requirements For Emergency Communications At And Around New FS 56

This section describes the operational requirements associated with FS 56. There are four critical operational requirements within the FS 56 area, which are common elements of the Fire District Communication system that are implemented throughout Ventura County:

- Fire Station Alerting
- VHF Radio System (Talk-In)
- VHF Radio Repeaters
- VHF Radio Base Stations (Area Command)

1.2.1 Fire Station Alerting System Requirements

1.2.1.1 Provide the Fire District's Fire Station Alerting system. Engine companies and other resources (e.g. Fire Apparatus, Ambulances, and Chief Officers) are alerted to requests for fire, rescue, and emergency medical services via an audible tone that is broadcast over the Fire District's proprietary VHF radio system. This tone signaling activates an alerting system in the fire station that provides audio and visual cues alerting station personnel that an immediate response is required to preserve life, limb, property, or the environment. This alerting process and the dispatcher's voice transmission are the primary means to notify the Fire personnel of an emergency event.

1.2.1.2 Provide 99.999% reliability of the Fire District's Fire Station Alerting system, including ensuring receipt of the transmitted alerting signal is 99.999% reliable at each fire station. A reliable Fire Station Alerting System is essential to responding promptly to citizen calls for assistance. Given the limitations of the current radio system in the FS 56 operational area, it is vital that the VHF communication path between Point Mugu and FS 56 be highly reliable.

1.2.1.3 The Fire District's current radio system configuration must be used at the time new FS 56 opens, which means the signal to alert FS 56 must be broadcast from a radio site at Naval Base Point Mugu and must be received via an antenna system and a Motorola Minitor radio pager installed at Fire Station 56.

1.2.2 VHF Radio System (Talk-In) Requirements

1.2.2.1 The Fire District requires communications between dispatch and field personnel, on eight VHF channels, across Ventura County and into neighboring areas in adjacent Counties. If feasible, it is desired that radio coverage for FS 56 extend beyond the Ventura County/Los Angeles County line south to Leo Carillo State Beach.

1.2.2.2 Each of the Fire District's operational areas, including FS 56, require availability of three VHF radio channels: Dispatch, Primary Command, and Secondary Command.

1.2.2.3 Support use of mobile radios (vehicle mounted radios) in each operational area.

1.2.2.4 Support use of portable radios (hand-held radios) in each operational area. This study will focus on this "worst case" portable coverage

requirement since Fire District personnel rely on portable radios and reliable portable coverage is the most difficult to achieve.

1.2.2.5 Support in-building portable coverage where possible, as may be achieved in specific areas depending upon the actual RF site locations utilized.

1.2.2.6 Support 12.5 KHz frequency narrow banding as mandated by the FCC, which the Fire District will be implementing in conjunction with its planned new simulcast radio network.

1.2.3 VHF Radio Repeater Requirements

1.2.3.1 The Fire District requires radio repeaters throughout the County to facilitate communications between field personnel, and when necessary, between field personnel and dispatch.

1.2.4 VHF Radio Base Stations (Area Command)

1.2.4.1 The Fire District requires radio base stations at geographically and operationally strategic locations for the purpose of establishing local area command and control. This is a critical requirement, with low frequency of occurrence / high-risk implications.

1.2.4.2 Base stations are essential to establishing area command and control during major incidents and other disasters, in the event the primary radio system fails, and in the event the Fire District's operational capabilities are degraded to the point where area command is necessary.

1.3 Document all Technical Requirements for Emergency Communications Relative to Operations in and Around New FS 56.

This section describes the technical requirements associated with the operational requirements.

1.3.1 Radio System Reliability Requirements

1.3.1.1 Introduce no additional points of failure into the Fire District's radio system.

1.3.2 Fire Station Alerting System Requirements

1.3.2.1 At the time FS 56 opens, utilize the Point Mugu Naval Base transmit site and the Fire Station Alerting/Primary Dispatch Channel operating on 154.0100 MHz.

1.3.3 VHF Radio System (Talk-In)

1.3.3.1 At the time FS 56 opens, continue to utilize the Fire Station Alerting/Primary Dispatch Channel operating on 154.0100 MHz for talk in and talk out.

1.3.4 VHF Radio System Coverage Requirements

1.3.4.1 The Fire District's desired two-way radio coverage requirements are 95% area reliability with a Delivered Audio Quality (DAQ) level of 3.0 or better that conforms to the Telecommunication Industry Association (TIA) document TSB-88-B.

1.3.4.2 This area coverage reliability will be achieved while using a 5-Watt portable radio (Motorola MT-2000) at street level (not inside buildings or under-ground parking structures) with the portable held at head level while transmitting and receiving.

1.3.5 Radio Site Connectivity Requirements

1.3.5.1 Primary Sites: Utilize the County's new digital Public Safety Microwave System infrastructure for the nineteen included primary sites.

1.3.5.2 Alternate Sites: The preferred mode is to utilize the County's digital microwave infrastructure. The minimum mode is to utilize C2 Conditioned leased line circuits.

1.3.6 Radio Site Primary Power Requirements

1.3.6.1 Provide commercial power and/or solar power sufficient to run the required complement of radio equipment.

1.3.7 Radio Site Backup Power Requirements

1.3.7.1 Be equipped with a UPS Battery system with charger and AC Generator

1.3.8 Radio Site Environmental Requirements

1.3.8.1 Provide a conditioned space suitable to support equipment BTU requirements, proper electrical grounding and lightning protection to support life-safety, equipment warranty and longevity of equipment.

1.3.8.2 Provide available rack space for the required complement of radio equipment.

1.3.8.3 Must meet the minimum life-safety specifications of Motorola's R56 Standards and Guidelines for Communication Sites.

1.3.9 Radio Site Security Requirements

1.3.9.1 Provide a secured, access-restricted and tamper-proof building with appropriate fencing and locks

1.3.10 Radio Site Access Requirements

1.3.10.1 Allow access twenty-four hours a day, seven days a week.

1.3.10.2 Provide road access suitable for vehicles, construction equipment and materials transport

1.3.11 Radio Site Antenna System Requirements

1.3.11.1 Utilize an antenna tower structure to support interference isolation, radiation exposure limits and VHF RF propagation.

1.3.11.2 At other locations throughout the County, the Fire District has adopted the standard of a 60-foot antenna tower designed for a foundation and base to support possible future expansion up to 80 feet.

1.3.11.3 For FS 56, utilize a monopole antenna located at the FS 56 site.

- The antenna system at FS 56 cannot be roof mounted because penetrations of the roofing system for a roof mounted antenna system would void the builder's warranty.
- The roofing system installed at FS 56 is a "thermoplastic membrane roofing system installed over rigid insulation".

Ventura County Fire Protection District
Study of RF Communications—New Fire Station 56
Deliverable 2—Statement of System Characteristics

2. Documentation of System Characteristics (Current System Capabilities and Planned Improvements)

2.1 Overview of the Fire District's Radio Systems.

The Fire District utilizes a proprietary conventional VHF tone-controlled (voted) public safety radio system and radio network. The Fire District desires to improve radio coverage throughout the County and plans to upgrade the existing radio network to a simulcast configuration for eight distinct radio channels. There are four critical operational requirements within the FS 56 area, which are common elements of the Fire District's Communication system:

- Fire Station Alerting
- VHF Radio System (Talk-In)
- VHF Radio Repeaters
- VHF Radio Base Stations (Area Command)

2.2 Document Digital Microwave System Characteristics.

2.2.1 Current System Characteristics.

The current microwave system is nearing the end of its useful life and has limited connectivity to the Fire District's radio sites. The County's current microwave system is a Harris DVM-45 digital microwave that provides repeater site connectivity between the six major mountain top radio sites and operates in the 6 GHz band. Few of the Fire District's receive sites are currently connected to the microwave system and instead utilize 2-wire and 4-wire leased-line circuits.

2.2.2 Future System Characteristics Based On Planned Improvements.

The County is building a new digital public safety microwave network, which will provide connectivity between all the primary radio sites and dispatch centers and is planned for completion within the next twelve months. The County's new public safety microwave network will provide increased capacity for nineteen sites (versus six current microwave sites) and will support the simulcast radio networks of the Fire District and the Sheriff's Department. The new public safety microwave network will be comprised of a dual loop Harris Constellation microwave network with a bandwidth of four DS3's that will transport radio communications for the Fire District between its dispatch center and the nineteen planned microwave sites. The Fire District will have a dedicated DS3 for its radio traffic, and a dedicated T1 and a Zhone IMACS Model 800 channel bank at each remote location required to simulcast the Fire District's radio channels. The new public safety microwave system and will employ loop-switching plus hot-standby architecture to increase system reliability.

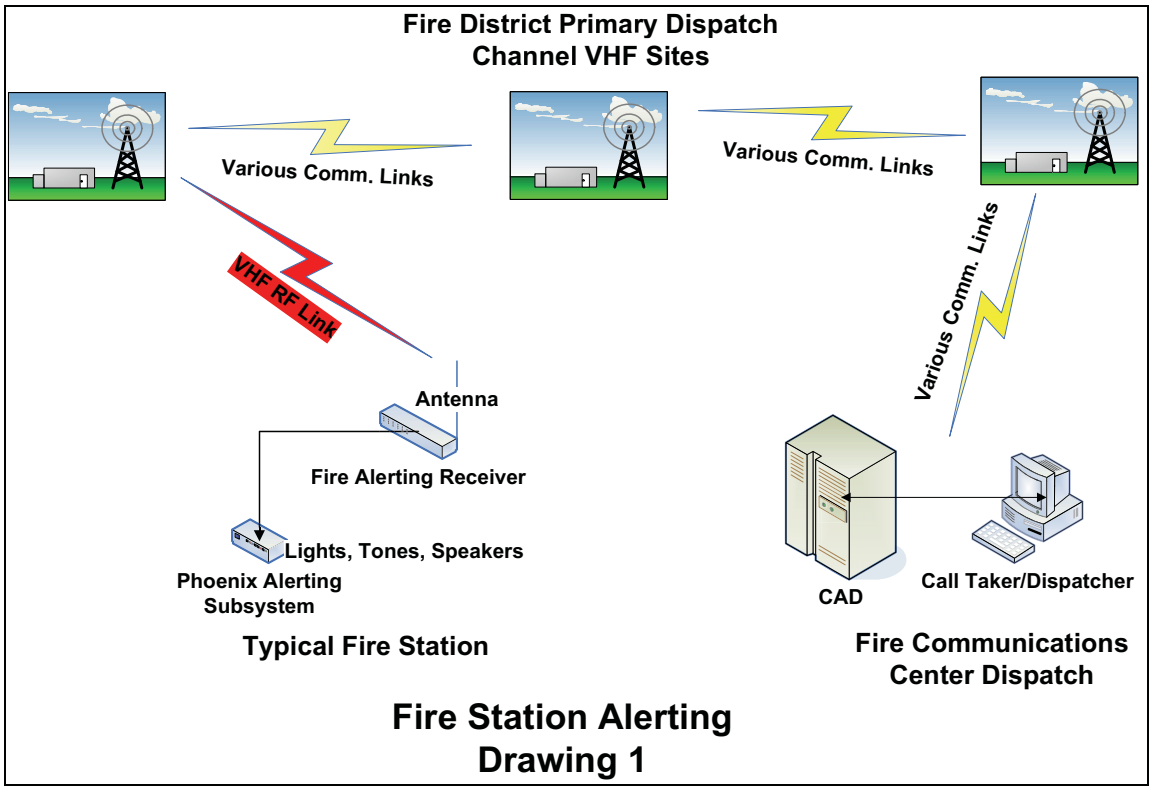
2.3 Document Fire Station Alerting System Characteristics.

2.3.1 Current System Characteristics.

The Fire Station Alerting system is broadcast over the Fire District's simplex Primary Dispatch Channel, via a Zetron Model 25 tone generator and the Motorola Quick Call II signaling format. An interface from the Fire District's Computer Aided Dispatch System selects the appropriate RF transmit site to broadcast the Motorola Quick Call alert tone based on the station assignment of the resource(s) dispatched to the incident. Immediately thereafter, the Fire/EMS dispatcher selects the appropriate RF site in each geographic area and announces the radio designator(s) of the unit(s), call type, address of incident (twice), map book page, repeats the call type, and assigns a command channel.

A VHF transmit radio at the Point Mugu Naval Base supports alerting FS 56 and uses the Primary Dispatch Channel operating on 154.0100 MHz. A Motorola Minitor radio pager at FS 56 receives the alert tones and provides an output that activates the Fire Station alerting subsystem. The Fire Station alerting subsystem activates designated alarms in the station and routes the dispatcher's subsequent voice message to loud speakers inside the station.

Vulnerable points of failure in the Fire Station Alerting System are the transmit (transmit site radios) and receive radios (fire station radios). As illustrated in Drawing 1, the Fire Station Alerting system is currently supported by a variety of communication link types, which include the County's current microwave system and 2-wire and 4-wire leased-line circuits.



Refer to Table 1 for a summary of the communications path characteristics.

Table 1 – FS 56 Alerting System, Communications Path Summary

Site Attribute	Point Mugu Transmit Site	FS56 Receive Site
Site Coordinates	34-05-46 N 119-06-26 W	34-03-03 N 118-57-17 W
Transmitter Power	50 watts	Not applicable
Antenna Model/Gain	Sinclair SY203/5.5 dBd	Celwave Stationmaster (5.5 dBd)
Effective Radiated Power	100 watts	Not applicable
Antenna Height (above ground level)	60 feet	55 feet (based upon test results)
Reliability for Alerting and Voice	Not applicable	99.999%

2.3.2 Future System Characteristics Based On Planned Improvements.

The Fire District will be upgrading their current VHF radio system to simulcast operation, which will utilize the County's new Public Safety Microwave System. This will allow the Motorola Quick Call alert tones and dispatcher audio to be broadcast simultaneously from all RF sites. In addition to improving radio system coverage, the simulcast system will streamline the dispatch operation by alleviating manual selection of transmitter site(s) by the Fire/EMS dispatcher.

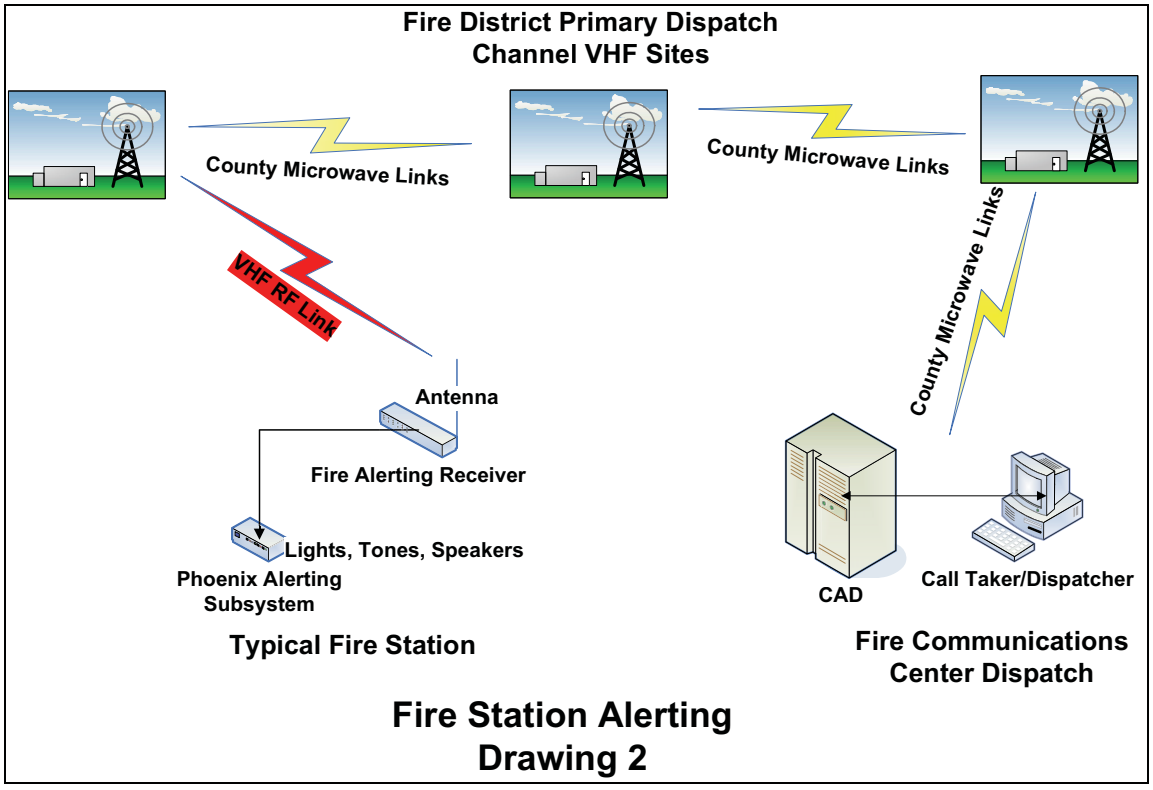
The Fire District plans to replace the Motorola Minitor radio pagers located at Fire Stations (including FS 56) for the Fire Station Alerting System with Motorola GM300 radios.

Planned improvements specific to FS 56 include the installation of a G2 Phoenix Fire Station Alerting subsystem that produces the visual and audible station alarms. The Fire Station Alerting VHF two-tone receiver will be integrated into the US Digital Design (USDD) system. The alerting receiver is a critical component and must be mounted adjacent to the USDD subsystem to ensure adequate audio levels and reliable,

interference-free operation. The planned improvements will allow the Fire District to meet its requirement for receipt of the transmitted alerting signal to be 99.999% reliable at FS 56.

Installing the VHF alerting receiver at any location other than FS 56 will introduce additional points of failure and potential audio degradation that is not acceptable for a public safety alerting system. The Fire District is unwilling to add any additional potential points of failure into the architecture of the Fire Station Alerting System beyond those that must already be tolerated and managed/mitigated, given the significant risk of delaying responses to citizens calls for service.

As illustrated in Drawing 2, the Fire Station Alerting system will be supported by the County's new Public Safety Microwave System.



Fire Station Alerting
Drawing 2

2.4 VHF Radio System (Talk-In).

2.4.1 Current System Characteristics.

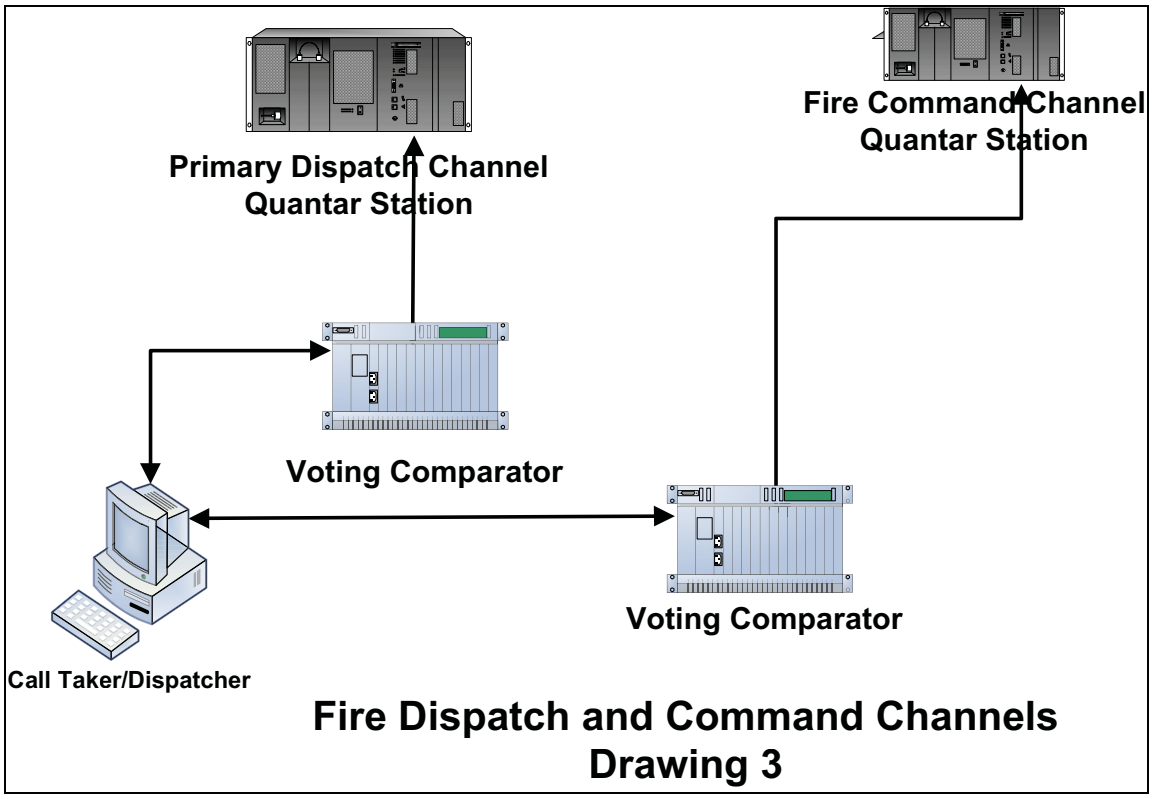
VHF base station radio receivers and transceivers installed at fire stations and mountain-top sites around the County make up the Fire District's primary radio system. Each of these radio sites contributes to the overall radio system by providing radio coverage for a portion of the County. The Fire District currently utilizes Quantar base station radios at transmit sites and AstroTAC radios at receive sites

The Fire District's existing radio network uses voted receive sites and stand-alone transmitters configured as a VHF tone-controlled conventional system. The primary power source at each remote site is –48VDC and 120VAC with generator backup. The Fire District currently uses Motorola Quantar base station radios, Raytheon/JPS SNV-12 voters, and a Zetron Acom radio switch/dispatch console system.

In most of the Fire District's operational areas there are at least two operational radio channels used by Fire personnel: the Primary Dispatch Channel and an area or zone Command Channel. However, communications in the FS 56 operational area are limited to just the Primary Dispatch Channel. VHF radio communications on other channels is not possible at this time due to extreme terrain blocking and the lack of adequate tower-supported antenna systems within the operational area.

The Primary Dispatch and Command channels operate in the simplex mode and are comprised of multiple transmitter and voting receiver sites. Dispatcher-to-portable radio user communications rely on the outbound RF coverage reliability achieved from each individual radio site. Dispatchers must manually select the appropriate geographic site to communicate with the targeted portable radio user or group of users. Since these are simplex (non-repeated) channels, the capability of portable radio users to communicate directly with each other is limited to short distances. This is due to the low level antennas and lower effective radiated power of the portable radio transmitters.

Drawing 3 illustrates a typical configuration of a Dispatch base station and a Command channel base station. In the following descriptions, the terms "dispatcher" and "portable radio user" will be used to describe communications between the dispatchers in the Fire Communications Center and the Fire personnel in the field.



Fire Dispatch and Command Channels
Drawing 3

The Dispatch Channel base station's primary use is to support Fire Station Alerting and to dispatch emergency call voice messages. This channel operates in the simplex mode of operation. At any point in time, the simplex mode of operation supports either an outbound talk-path from the dispatcher to the portable radio user, or an in-bound talk-path from the portable radio user to the dispatcher.

The Command Channel base station's primary use is to support incident communications between portable radio users and portable radio users to dispatch. This allows the portable radio users to communicate freely on a separate radio channel while the Primary Dispatch channel is reserved for dispatching new emergency calls.

These RF channels employ voting comparator operation to enhance the in-bound portable radio-to-dispatcher communications. Voting comparator operation allows the audio from multiple geographically separated receivers to be compared and then forward the best quality

audio to the dispatcher. The Fire District also has implemented many receive-only voting sites to improve in-bound communications.

2.4.2 Future System Characteristics Based On Planned Improvements.

Concurrent with the new public safety microwave system installation and optimization, the Fire District will be upgrading their current VHF radio system to simulcast one countywide dispatch channel and seven regional command channels, which will provide improved radio system coverage, system redundancy and better ease-of-use. The Fire District has a total of fifteen transmit sites licensed for simulcast per an updated channel plan and frequency coordination and reallocation. This will allow the messages on the Primary Dispatch and Command channels to be broadcast simultaneously from all the primary RF sites. The Command Channels that will be designated in the future, after the planned system improvements for the FS 56 operational area, are Coastal South and West Command.

The simulcast network will allow Fire dispatchers to broadcast messages simultaneously from multiple RF sites within each geographic command area, or across the entire operational area using the Primary Dispatch channel. System users gain consistent, uniform radio coverage, simplifying communications for both dispatchers and portable radio users.

During the simulcast system upgrade, the Fire District will also convert their current simplex channels to duplex operation, except the Primary Dispatch channel since its primary usage is for outbound notification. Duplex operation supports repeater operation with enhanced wide-area communications between portable radio users. The duplex operation improvements for the Command channel will produce positive enhancements within the FS 56 operational area.

Also, the Fire District has secured FCC licenses for additional operating frequencies to allow the upgrade to duplex operation on these channels, and frequency reallocation will occur across the Fire District's radio plan. The Command channels in each area will then support duplex repeater operation which will improve portable radio-to-portable radio communications throughout a much wider area than can be achieved in the current system. Improved portable radio-to-portable radio communications across the command areas will enhance the efficiency of the District to coordinate emergency events and deliver higher levels of public service.

The Fire District also intends to implement 12.5 KHz frequency narrow banding in conjunction with implementing its planned new simulcast radio

network and will reprogram its compatible mobile and portable radios accordingly. The Fire District's portable radios, mobile radios and radio pagers utilized in the narrow band simulcast radio network will need to support narrow band frequencies and the Intermediate Frequency bandwidth filtering of 11 KHz.

FS 56 is a logical location to install voting receivers for the Dispatch and Command Channels and section III of this study will summarize coverage prediction scenarios and illustrate improvements gained from voting receiver operation.

2.5 VHF Radio Repeaters.

This section describes the potential to improve system reliability and redundancy by utilizing a VHF repeater station within the FS 56 operational area. Radio repeaters installed at fire stations and mountain-top sites around the County provide radio communications for mobile and portable radio users when the Fire District's primary radio system is inoperable. Repeater stations provide improved tactical communications in the vicinity of the site in the event of a wildfire, and also serve to backup the primary radio system in the event of a partial or complete failure. It is crucial that the isolated areas along the Ventura County coastline have adequate back-up communications when the primary radio system is inoperable or degraded.

2.5.1 Current System Characteristics.

Repeater stations are installed in strategic locations to provide improved tactical communications in the vicinity of the site in the event of a wildfire, and also serve to backup the primary radio system in the event of a partial or complete radio system failure, which enhances the redundancy and reliability of the system.

During normal operation these repeater stations remain in a standby mode. When the Fire District determines it is necessary to use repeater stations, each individual station is manually activated to support emergency communications in various wildfire areas, or if the primary system is not functional or has limited capability to support normal operations.

Duplex operation is supported by the station's receiver, which will automatically forward the received messages to the station's transmitter for broadcast to the other portable radio users.

2.5.2 Future System Characteristics Based On Planned Improvements.

The Fire District is planning to equip the backup repeater stations with remote control activation over the RF channel. This feature will allow the Fire District to readily set up the repeater when it is needed and return the repeater station to the standby mode when it is no longer needed to maintain emergency communications.

A limited number of the Fire District's RF sites have the potential to provide coverage within the FS 56 operational area. The addition of a strategically located backup repeater station within the FS 56 operational area is essential to maintain communications in this isolated part of the County.

Since it is crucial that the isolated area along the Ventura County coastline have adequate back-up communications when the primary radio system is inoperable, FS 56 is a logical location to install a repeater station.

2.6 VHF Radio Base Stations (Area Command).

Base station radios are currently installed at fire stations around the County to provide direct local and regional radio communications from the fire station to emergency services personnel. This critical requirement has low frequency of use / high-risk implications.

2.6.1 Current System Characteristics.

The Fire District has implemented VHF radio base stations at strategic locations to support area command operations. Base stations are essential to establishing area command and control during major incidents, during natural disasters, when the primary radio system fails, or when operational capabilities are degraded to the point where area command is necessary.

During area command operation, there may be multiple agencies involved. Some of these agencies may be from other County or City governments, which requires multiple transmit antennas to support the frequency bands necessary to coordinate the range of emergency events.

2.6.2 Future System Characteristics Based On Planned Improvements.

Planned improvements for the FS 56 operational area include the installation of a new VHF base station with an antenna system that will support the required frequency bands and required coverage reliability.

3. Analysis of FS 56 Radio Transmissions

3.1 Analyze Transmissions From The Fire District's Radio System.

Radio frequency field-testing was conducted at various locations throughout the FS 56 operational area on March 26 & 27, 2008. Refer to Attachment A – RF Test Plan for a description of the tests that were conducted and the data collected.

The RF Test Plan data and the site information gathered during the testing was used by Motorola to analyze and evaluate methods to support the Fire District's four main operational requirements:

3.1.1 Fire Station Alerting System

3.1.2 VHF Radio System (Talk-In)

3.1.3 VHF Radio Repeaters

3.1.4 VHF Radio Base Stations (Area Command)

3.2 Determine the necessity for an antenna tower at new Fire Station 56.

Motorola concluded an antenna tower at FS 56 is necessary to meet the Fire District's operational and technical requirements. Motorola recommends an antenna tower height of at least 55 feet, with a receive antenna mounted at the top (55 feet) and four transmit antennas mounted at 32 feet.

An antenna height of 55 feet with the receive antenna at the highest level of the tower structure will help achieve the required interference isolation from the site's transmitters, allows the transmit antennas to be installed above FS 56's roofline of 28 feet, provides the minimally acceptable vertical height separation between the transmit and receive antennas, and ensures the optimum performance of the system receivers.

- For inbound communications (receive antenna), the Fire District's standard is the 20 foot Stationmaster antenna (with 5.5 dB gain).
- For outbound communications (transmit antennas), the Fire District's standard is 8 foot Comtelco antennas (3 dB gain), tuned to the required frequency bands utilized at each transmit site.

The minimum physical isolation between receive and transmit antennas in the recommended antenna tower configuration is 15 feet vertically, measured from the tip of the transmit antennas to the bottom of the receive antenna, which ensures the transmit antennas' radiation patterns are not obscured or distorted by the rooftop of FS 56 and provides for optimum receiver performance. Refer to the Area Command section (3.4.2) for additional detail regarding the antenna isolation requirements.

Utilizing a monopole antenna tower would minimize the public view impacts to the extent practicable and is less damaging to the public viewshed than a lattice antenna structure or other available alternate antenna tower types would be.

3.2.1 Fire Station Alerting System

Refer to Attachment B – Predicted Path Reliability for a depiction of the path reliabilities for the various receivers tested.

Analysis of the RF test data confirmed that the utilization of a Quantar receiver or a GM300/Maxtrac receiver for the Fire Station Alerting System at the new FS 56 site will require an antenna tower with a minimum receive antenna height of thirty feet to support Fire Station Alerting at 99.999% reliability. Analysis of the RF test data also confirmed that utilizing a Minitor receiver at the new FS 56 site will not achieve the desired path reliability with a receive antenna height of 30 feet. The use of a Minitor receiver to support Fire Station Alerting at this location is not recommended due to insufficient receiver sensitivity.

However, as stated earlier, with the additional requirements for transmit antennas and the related requirements for interference isolation, the minimum recommended tower height to support both receive and transmit functions is a 55 foot antenna tower.

3.2.2 VHF Radio System (Talk-In)

During the RF testing process, the current voting receiver site at Point Mugu was evaluated for its suitability to continue supporting the VHF Radio System (Talk-In) for dispatch and command communications.

3.2.3 VHF Radio Repeaters

The FS 56 site was evaluated as a repeater site to support the Fire District's requirement for enhanced portable-to-portable communications within the FS 56 operational area.

3.2.4 VHF Radio Base Stations (Area Command)

This critical operational requirement requires the installation of radio base station transceivers at FS 56 to support area command operations during disasters or major incidents, when the primary system is not available for use, or as otherwise necessary to support operational needs.

The Area Command base station receiver will share the same Stationmaster antenna as the Fire Station Alerting System's receiver and will be mounted at the highest level of the tower structure. The Area Command transmitters will utilize separate transmit antennas mounted

below the receiver antenna. The Fire District should install a total of four transmit antennas to support VHF (two different frequency bands), UHF, and 800 MHz communications, which are required for interoperability with neighboring agencies during disasters and major incidents such as earthquakes, wildfires and mudslides.

The minimum required physical spacing between the receiver and transmitter antenna will be 15 feet, measured from the tip of the transmitter antenna to the bottom of the receiver antenna. This physical spacing will provide the interference isolation required for optimum receiver performance.

In order to model the coverage reliability for the Area Command base station, the FS 56 operational area was defined as extending from Mugu Rock in the north to the Leo Carrillo State Park to the south. Refer to Attachment E – FS 56 Operational Area, which depicts the operational area of approximately 44 square miles used in the coverage modeling process.

Refer to Attachment F – FS 56 Area Command Coverage Map Sets A-D to view the predicted coverage areas for the Area Command base stations. The colored area on the maps (green for dispatcher-to-portable outbound, and red for portable-to-dispatcher inbound) illustrates the predicted 95% area reliability for Delivered Audio Quality Level 3.0 (DAQ 3.0). These maps have been created in accordance with the Telecommunications Industry Association (TIA) recommendations for Public Safety wireless communications coverage modeling.

Coverage modeling was conducted for various combinations of receiver and transmitter antenna heights at the FS 56 location. The coverage model predicts the reliability of achieving DAQ 3.0 for each one arc-second tile within the operational area. A one arc-second tile is approximately the size of a baseball diamond, about 90 feet by 90 feet. For each tile that is predicted to meet the reliability and audio quality criteria, the modeling program will color this tile either green (for outbound) or red (for inbound) as noted earlier.

The first three sets of maps (A-C) are based on tower-mounted antennas that use vertical spacing between the transmitter and receiver antennas to achieve the interference isolation.

Map Set A: (1) Inbound – Receiver Antenna base at 100 feet, and (2) Outbound – Transmitter Antenna base at 77 Feet. This map is the “best case” scenario, achieving the greatest coverage area reliability and assumes the use of a one hundred foot tower structure. This

configuration achieves the necessary isolation between the antennas to ensure optimum receiver performance.

Map Set B: (1) Inbound – Receiver Antenna base at 55 Feet, and (2) Outbound – Transmitter Antenna base at 32 Feet; which are the minimum antenna heights recommended by Motorola for FS 56 to support the Fire District's operational and technical requirements. This approach assumes a fifty-five foot tower structure, which will provide the necessary physical isolation between antennas and ensures the transmitter antenna's radiation pattern is not obscured or distorted by the rooftop of FS 56.

Map Set C: (1) Inbound – Receiver Antenna base at 50 Feet, and (2) Outbound – Transmitter Antenna base at 27 Feet. This configuration assumes a fifty foot tower structure. This configuration is not recommended since it does not provide sufficient obstruction clearance for the transmit antenna above the FS 56 rooftop (28 feet high per the FS 56 building plans).

Map Set D is described in section 3.3.4.

Table 2 below summarizes the predicted covered area in square miles for each map set (A-C) and lists the predicted number of one arc-second tiles that are covered for both inbound and outbound communications.

Table 2
FS 56 Area Command Channel – Map Comparisons
95% Area Reliability – DAQ 3.0

Map Set Details	Inbound Portable-to-Dispatcher		Outbound Dispatcher-to-Portable	
	Covered Area (mi^2)	Covered Tiles	Covered Area (mi^2)	Covered Tiles
Map Set A Rx Antenna at 100 Feet Tx Antenna at 77 Feet	3.6	11,803	5.9	18,959
Map Set B Rx Antenna at 55 Feet Tx Antenna at 32 Feet	2.4	7,872	3.3	10,738
Map Set C Rx Antenna at 50 Feet Tx Antenna at 27 Feet	2.3	7,464	3.0	9,751

3.3 Determine Alternatives, if any, to an Antenna Tower at New Fire Station 56.

3.3.1 Fire Station Alerting System

An alternative approach of rooftop mounting a receive antenna at FS 56 to support the Fire Station Alerting System is not recommended because this antenna must also support the Fire District's operational requirements of Talk-In voting receiver operation and Area Command emergency communications (operational requirements 3.1.1 and 3.1.4 listed at the beginning of this document and further explained herein).

The installation of the Fire Station Alerting receiver at an alternative remote radio site does not meet the Fire District's operational and technical requirements. A remote radio receiver site will exhibit points of failure that will not support the high reliability required for Fire Station Alerting. In addition, the alerting receiver must be adjacent to the Fire Station alerting equipment to ensure sufficient audio signal levels are maintained.

3.3.2 VHF Radio System (Talk-In)

During the RF testing process, alternative sites were identified and considered to support the VHF Radio System (Talk-In) for dispatch and command communications. The optimum required voting receiver site is FS 56, which will provide enhanced reliability in conjunction with the Point Mugu voting receiver.

Coverage modeling has identified additional potential receiver voting sites of Hess Kramer Water Tank, Gearry Hill and Laguna Peak. Utilization of these additional receiver voting sites will support and improve the inbound communications reliability for the Command and Dispatch channels.

Refer to Attachment C – Five Site Voting System for a depiction of the predicted coverage area reliability for the alternative receiver voting system.

3.3.3 VHF Radio Repeaters

The Hess Kramer Water Tank site was identified as an alternative VHF repeater site to support the Fire District's requirement for enhanced portable-to-portable communications within the FS 56 operational area. Refer to Attachment G – Hess Kramer Repeater Maps to view the predicted coverage area reliability for this alternative site.

3.3.4 VHF Radio Base Stations (Area Command)

An alternative approach of rooftop mounting receive and transmit antennas to support the VHF Radio Base Stations (Area Command) was evaluated. However, this approach is not feasible because the necessary interference isolation cannot be achieved between the transmit and receive antennas. Rooftop mounting of the antennas must rely on horizontal spacing, which would require over 350 feet of horizontal separation between the antennas. This physical separation is not achievable on the rooftop of FS 56.

Refer to Attachment F Map Set D: (1) Inbound – Receiver Antenna base at 28 Feet, and (2) Outbound - Transmitter Antenna base at 28 Feet. Map Set D is based on the transmitter and receiver antennas mounted on the rooftop of the FS 56 (at a height of 28 feet), which is not achievable on the rooftop of FS 56.

Similar to Table 2 in section 3.2.4 above, Table 3 below summarizes the predicted covered area in square miles for map set D and lists the predicted number of one arc-second tiles that are covered for both inbound and outbound communications.

Table 3
FS 56 Area Command Channel
95% Area Reliability – DAQ 3.0

Map Set Details	Inbound Portable-to-Dispatcher		Outbound Dispatcher-to-Portable	
	Covered Area (mi^2)	Covered Tiles	Covered Area (mi^2)	Covered Tiles
Map Set D Rx Antenna at 28 Feet Tx Antenna at 28 Feet	1.7	5,543	3.1	9,947

3.3.5 VHF Radio System (Talk-Out)

Although it is out of scope and not specifically requested by this study, Motorola determined that Laguna Peak is an excellent alternative site that would dramatically improve outbound dispatcher-to-portable communications (Talk-Out) within the FS 56 operational area. Laguna Peak covers this area more reliably than the current Point Mugu transmitter site. Refer to Attachment D – Laguna Peak Outbound to view the predicted area reliability for this site. Motorola recommends that the Fire District consider this site for inclusion in the Public Safety Simulcast Project.

3.4 Determine the Optimum Combination of an Antenna Tower at New Fire Station 56 and Alternatives, if one exists.

To obtain optimum radio system functionality for the Fire District, Motorola recommends a 55-foot antenna tower at FS 56, plus additional radio equipment at the Hess Kramer Water Tank, Gearry Hill and Laguna Peak sites.

Refer to Attachment H – Radio Sites FS 56 Area to view a map of the radio sites referenced in this deliverable document.

Refer to Attachment I - FS 56 Photo Simulations to view photo simulations from four different views of FS 56, both with and without the recommended 55-foot monopole antenna tower and the recommended antenna configuration referenced in this deliverable document.

Ventura County Fire Protection District
Study of RF Communications—New Fire Station 56
Deliverable 3—Draft Statement of Needs and Alternatives
Attachment A—RF Test Plan

Test Overview

This test plan describes the following three basic tests:

1. Measure and record the signal strength received at the New Fire Station 56 site from the Channel 1 transmitter at the Point Mugu site at various heights. This test will be conducted at the New Fire Station 56 site using a crane.

2. Determine the effective radiated power for the Point Mugu transmitter. This test will be performed at the Point Mugu site and includes measurements and calculations.

3. Measure and record the effective receiver sensitivity for a typical VHF receiver that may be utilized in the Fire District's system. The third test will be conducted at the New Fire Station 56 site and at the additional locations described herein.

Test Schedule

Date	Time	Location	Test Name
26 Mar 08	1000 hrs	New FS 56	Signal Strength Measurement
26 Mar 08	1100 hrs	New FS 56	Effective Receiver Sensitivity
26 Mar 08	1200 hrs	*Lunch Break and In Transit to Pt. Mugu*	
26 Mar 08	1300 hrs	Pt. Mugu	Effective Radiated Power
26 Mar 08	1400 hrs	Pt. Mugu	Effective Receiver Sensitivity
26 Mar 08	1500 hrs	Laguna Peak	Effective Receiver Sensitivity
26 Mar 08	1600 hrs	Pt. Mugu State Park Campground	Effective Receiver Sensitivity
27 Mar 08	0730 hrs	Sycamore Cove	Effective Receiver Sensitivity
27 Mar 08	0830 hrs	Water Tank	Effective Receiver Sensitivity
27 Mar 08	0900 hrs	End of Ellis Street	Effective Receiver Sensitivity
27 Mar 08	0930 hrs	Hess Kramer	Effective Receiver Sensitivity
27 Mar 08	1100 hrs	Leo Carrillo State Beach (2)	Effective Receiver Sensitivity
27 Mar 08	1200 hrs	Nicholas Canyon Beach	Effective Receiver Sensitivity

Ventura County Fire Protection District
Study of RF Communications—New Fire Station 56
Deliverable 3—Draft Statement of Needs and Alternatives
Attachment A—RF Test Plan

Test 1: Signal Strength Test	Location: New Fire Station 56
Equipment Required: 1. Aeroflex IFR test set. 2. 3 dBd gain omni-directional antenna. 3. RG-8 cable crane with man-cage. 4. Tape measure. 5. Cell phone. 6. Zip ties.	Preparation: 1. The cable will be attached to the antenna and the test set. 2. The antenna will be will be secured to the man bucket using zip ties. 3. The tape measure will be attached to the man bucket so that it reads zero at the base of the antenna.
Procedure: 1. Crane raises the man-bucket until the tape measure reads 20 ft at the site elevation. 2. Fire personnel direct the Fire Communications Center to key VNC 1 from Pt. Mugu. 3. Motorola measures and records the signal strength level indicated on the test set. 4. Crane raises the man-bucket an additional 10 ft increment. 5. Repeat steps 2-4 until the crane reaches its maximum extension. 6. Test complete.	
Test Data:	
Height Above Ground Level (feet)	Signal Strength (dBm)
20	-58
30	-55
40	-55
50	-55
60	-52
70	-52
80	-52
90	-56
100	-50
Test Site Coordinates:	34-03-03 N 118-57-17 W

Ventura County Fire Protection District
Study of RF Communications—New Fire Station 56
Deliverable 3—Draft Statement of Needs and Alternatives
Attachment A—RF Test Plan

Test 2: Effective Radiated Power Test	**Location: Point Mugu Transmitter**
Equipment Required: 1. Through-line wattmeter with load. 2. Connectors/adapters	Preparation: 1. Connect a through-line wattmeter at the output of the transmitter.

Procedure:
1. Fire personnel direct the Fire Communications Center to key VNC 1 from Pt. Mugu.
2. Motorola observe and record the output power for the station.
3. Connect the through-line wattmeter at the output port of the station's lightning arrestor.
4. Fire personnel direct the Fire Communications Center to key VNC 1 from Pt. Mugu.
5. Motorola records the power level.
6. Motorola will calculate the effective radiated power based on the line/connector losses and antenna gain.

Test Data:

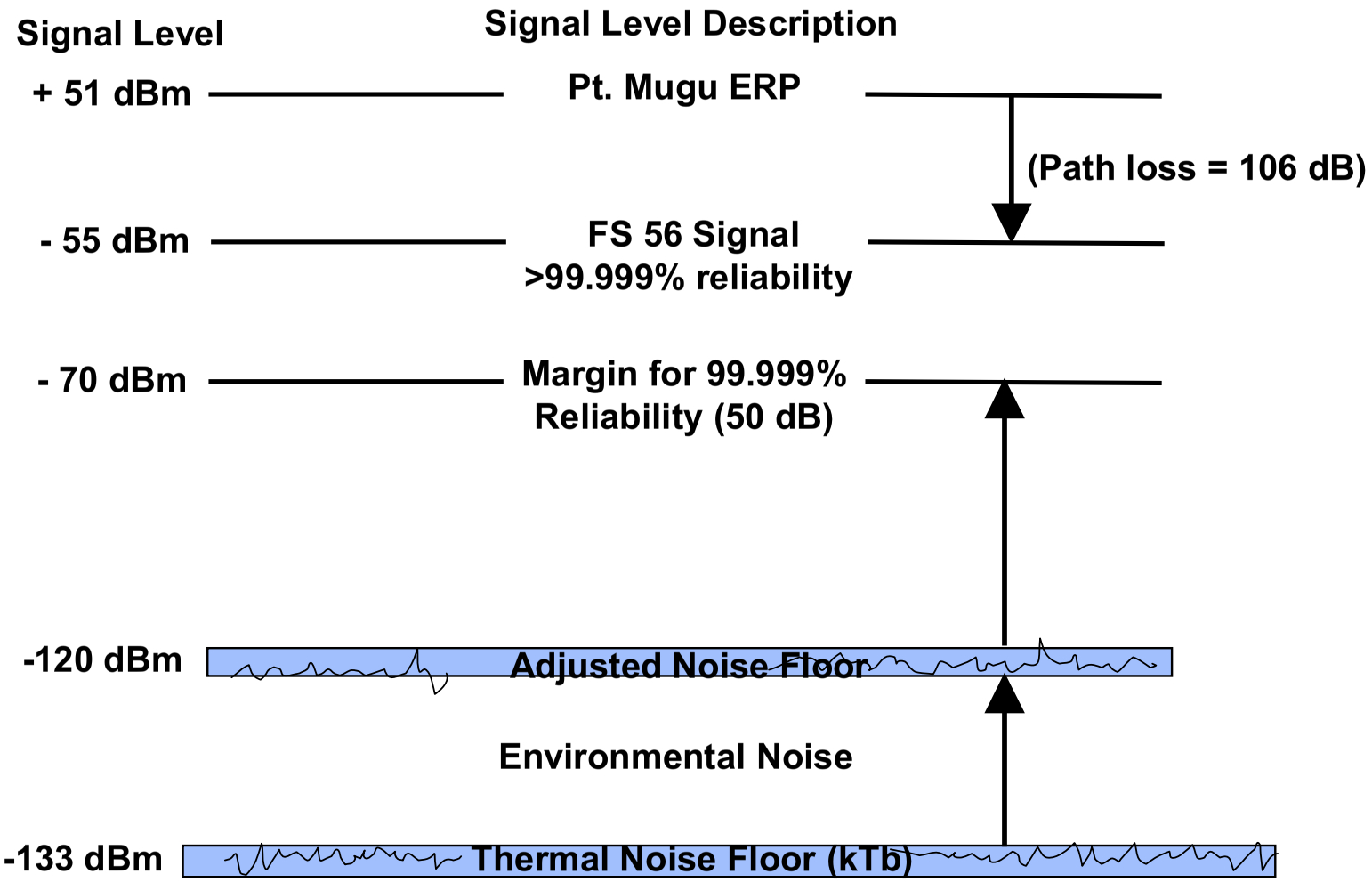
Power at Station Port (watts)	**Power at Lightning Arrestor output port (watts)**	**Line type/loss per 100'/line length/total loss + connectors**	**Antenna Model and Gain**	**Calculated Effective Radiated Power (watts)**
53.3	39.4	LMR400/1.5 dB/ 36 feet	Model SY203 5.5 dBd	15.95 dBW (arrestor output port) - .54 dB (LMR400 line loss) - .15 dB (connectors) - .14 dB (RG8 jumper) + 5.5 dBd (antenna gain) = 20.62 dBW = 116 watts
Test Site Coordinates:			**34-05-46 N 119-06-26 W**	

Test 3: Effective Receiver Sensitivity Test	Locations: Various
Equipment Required: 1. IFR Test Set. 2. SINAD test cable. 3. Iso-tee. 4. 3 dBd gain omni-directional antenna and transmission line 5. VHF Quantar receiver. 6. GM300 receiver. 7. Minitor receiver.	Preparation: 1. Set up the IFR Test Set to measure 12 dB SINAD sensitivity. 2. Set up antenna and transmission line
Procedure: 1. Connect the IFR Test Set directly to the Quantar receive port and measure/record the 12 dB SINAD sensitivity level. 2. Disconnect the IFR Test Set and connect an iso-tee to the receiver port. 3. Connect a 50 ohm load to the antenna port of the iso-tee. 4. Connect the IFR Test Set to the receiver via the iso-tee port and measure/record the 12 dB SINAD sensitivity level. 5. Remove the 50 ohm load from the iso-tee antenna port and connect the 3 dBd gain Omni-directional antenna to this port via the RG-8 cable. 6. Measure/record the receiver 12 dB SINAD sensitivity level while the antenna is connected. Repeat this procedure for the GM300 and Minitor receivers. 7. The GM300 and Minitor receiver will be tested at FS 56 but not at the remainder of the site locations.	

Test 3: Effective Receiver Sensitivity Test			Locations: Various	
Test Data:				
Test Receiver	Test Site Coordinates	12 dB SINAD (dBm)	12 dB SINAD with iso-tee terminated (dBm)	12 dB SINAD with iso-tee connected to antenna (dBm)
Fire Station 56:				
Quantar	34-03-01 N 118-57-17 W	-119.2	-81.7	-79
GM300/Maxtrac	34-03-01 N 118-57-17 W	-121.1	-83.8	-82.7
Minitor	34-03-01 N 118-57-17 W	-100.5	-64.1	-46
Point Mugu:				
Quantar	34-05-46 N 119-06-26 W	-119.2	-84.2	-79.6
Laguna Peak:				
Quantar	34-06-36 N 119-03-53 W		-82	-76.3
Point Mugu Park Campground:				
Quantar	34-04-55 N 119-02-00 W	-119.2	-81.8	-75.8
Sycamore Cove:				
Quantar	34-04-15 N 119-00-49 W	-119.2	-82	-74.7
Water Tank:				
Quantar	34-03-10 N 118-57-23 W	-119.2	-81.6	-72.7
End of Ellice Street:				
Quantar	34-03-05 N 118-57-17 W	-119.2	-81.7	-81.2
Hess Kramer:				
Quantar	34-04-01 N 118-58-18 W	-119.2	-82.1	-76.2
Leo Carrillo Ranger House:				
Quantar	34-02-54 N 118-57-09 W	-119.2	-82.1	-72
Leo Carrillo Lifeguard Station:				
Quantar	34-02-39 N 118-56-05 W	-119.2	-82	-71.5
Nicholas Canyon Beach:				
Quantar	34-02-35 N 118-54-55 W	-119.2	-82	-75.4

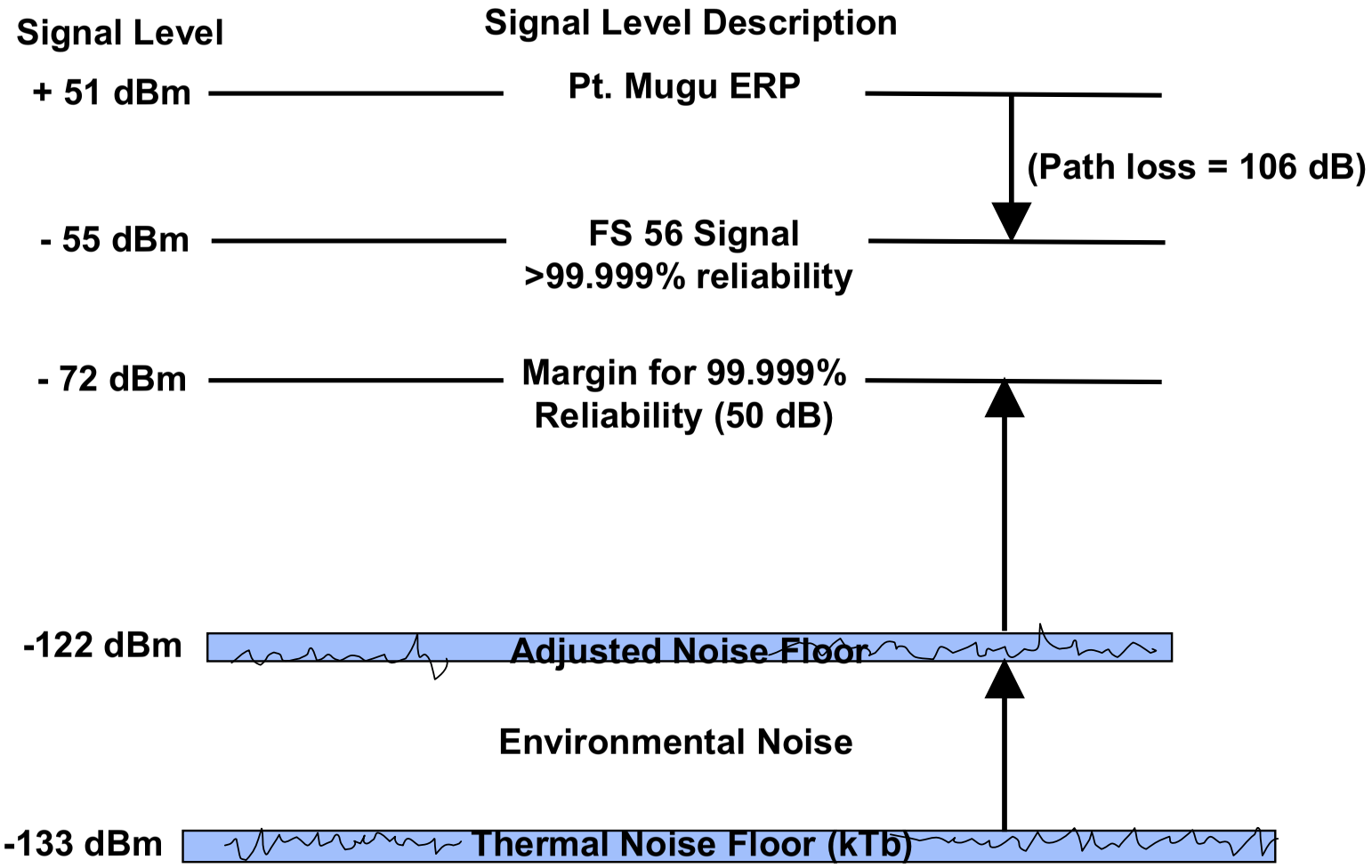
MOTOROLA

Ventura County Fire Protection District
Study of RF Communications—New Fire Station 56
Deliverable 3—Draft Statement of Needs and Alternatives
Attachment B
Predicted Path Reliability for FS 56 Quantar Receiver with a base station antenna at 30 Feet



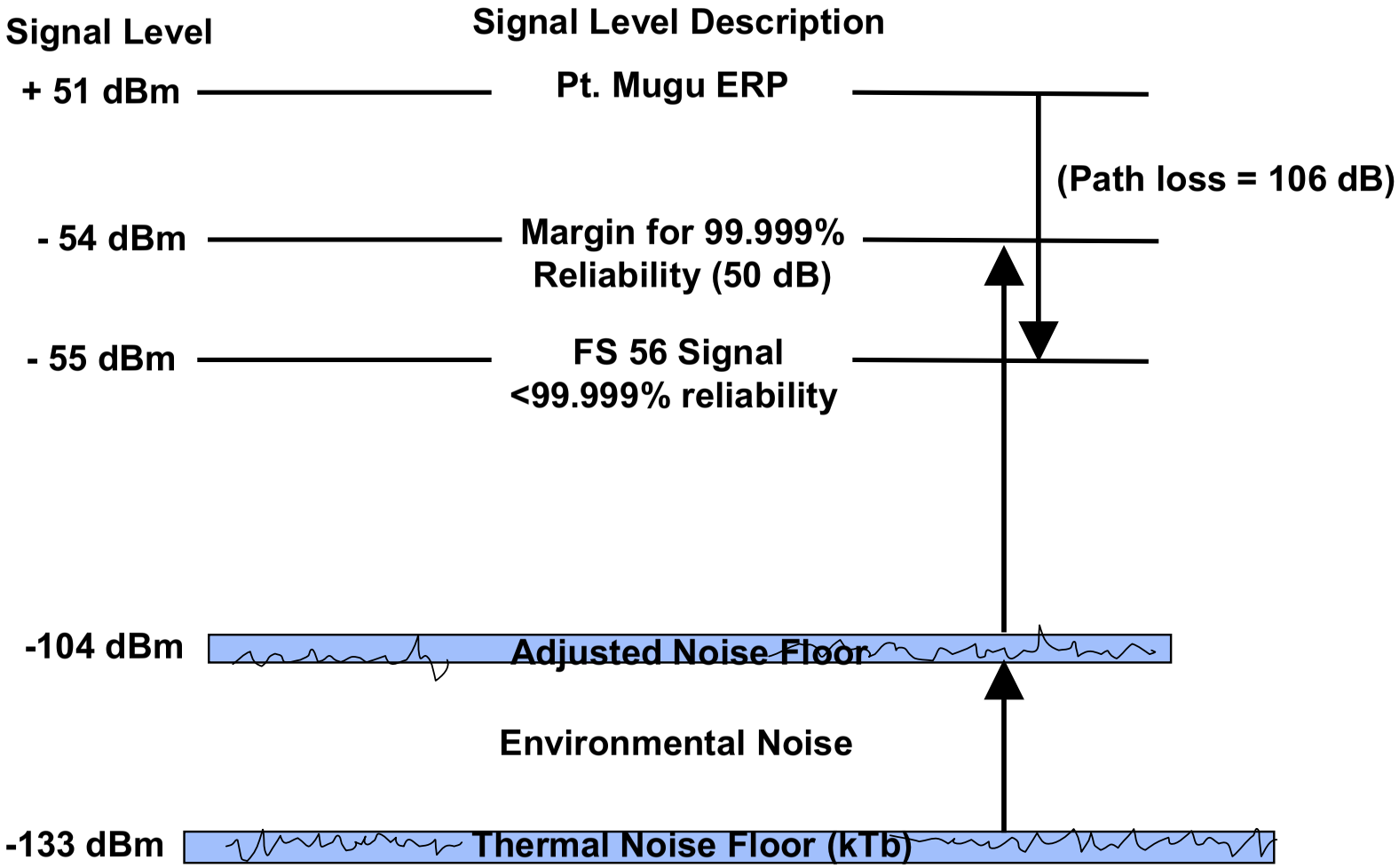
MOTOROLA

Ventura County Fire Protection District
Study of RF Communications—New Fire Station 56
Deliverable 3—Draft Statement of Needs and Alternatives
Attachment B
Predicted Path Reliability for FS 56 GM300 Receiver with a base station antenna at 30 Feet



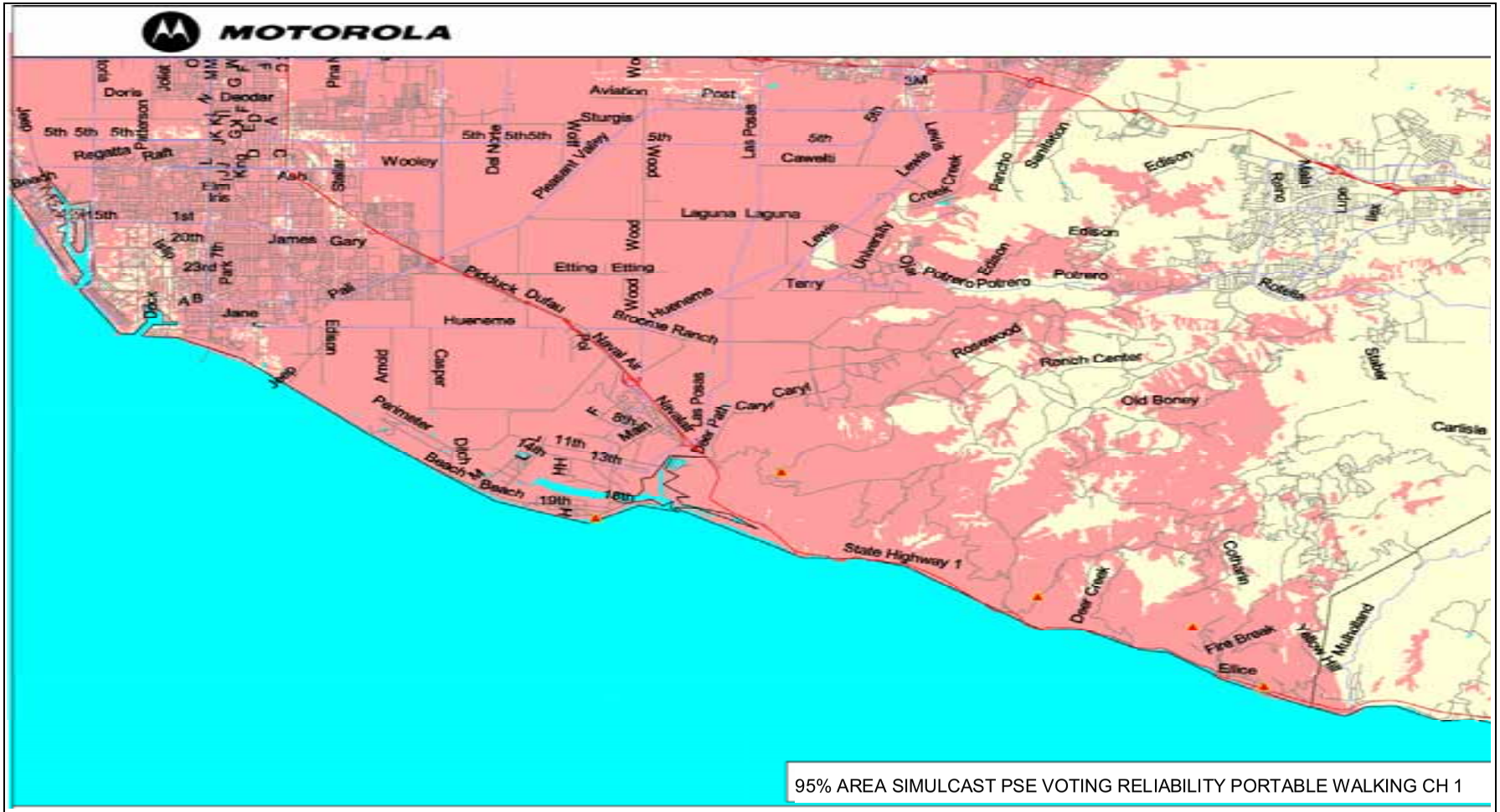
MOTOROLA

Ventura County Fire Protection District
Study of RF Communications—New Fire Station 56
Deliverable 3—Draft Statement of Needs and Alternatives
Attachment B
Predicted Path Reliability for FS 56 Minitor Receiver with a base station antenna at 30 Feet



MOTOROLA

Ventura County Fire Protection District
Study of RF Communications—New Fire Station 56
Deliverable 3—Draft Statement of Needs and Alternatives
Attachment C -- Five Sites FS 56 Voting System



Scale: 1 inch = approximately 2.00 miles @ 1/126720

Portable-to-Dispatcher On Street at Hip Level

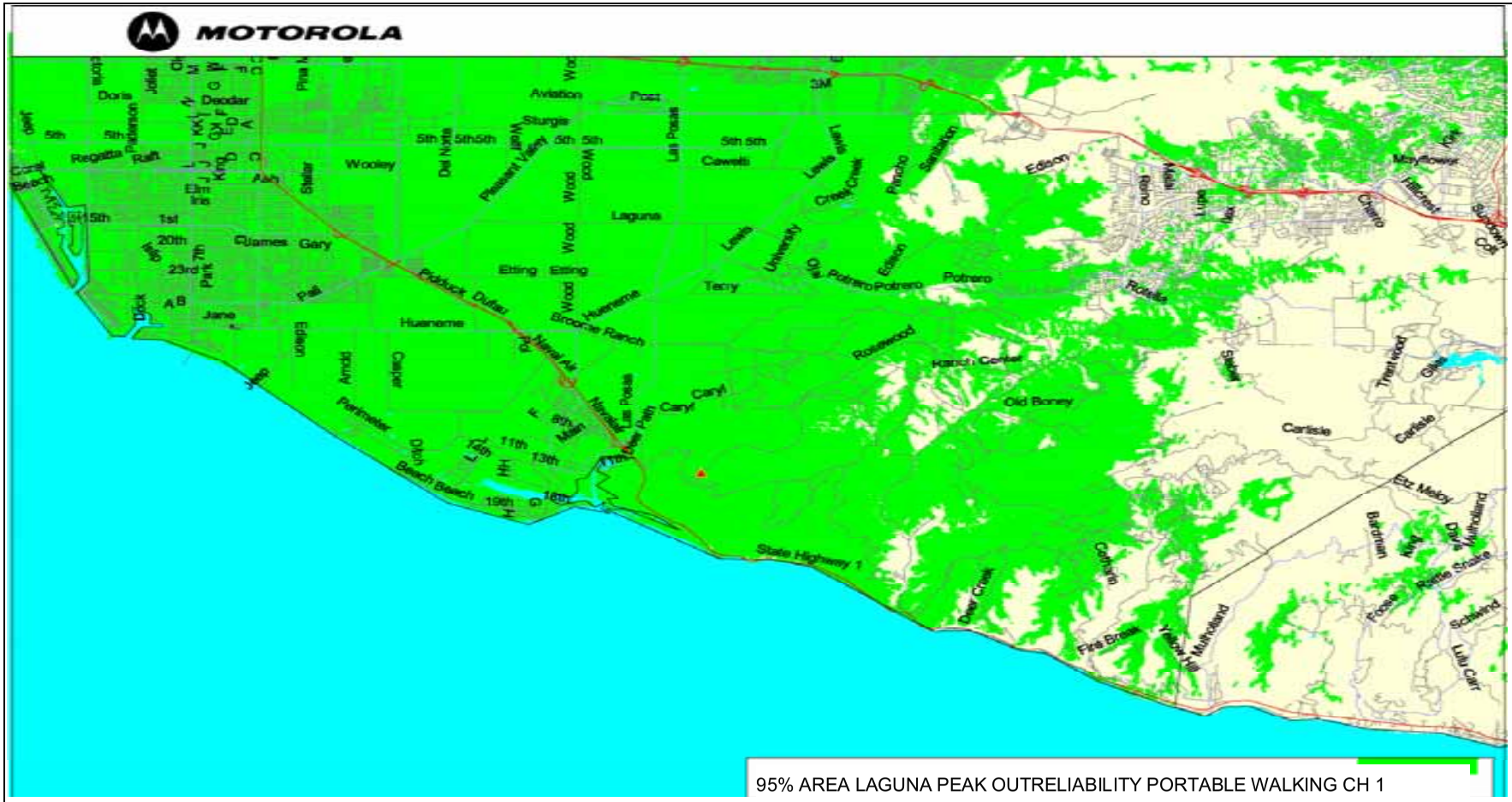
Monday, April 14 2008 3.20 Build 3355

Job Id : 547028913.5.000.1.11

Portion(s) Of GIS Source Data Provided By ESRI, Inc.

MOTOROLA

Ventura County Fire Protection District
Study of RF Communications—New Fire Station 56
Deliverable 3—Draft Statement of Needs and Alternatives
Attachment D – Laguna Peak Outbound



Scale: 1 inch = approximately 2.00 miles @ 1/126720

Portable-to-Dispatcher On Street at Hip Level

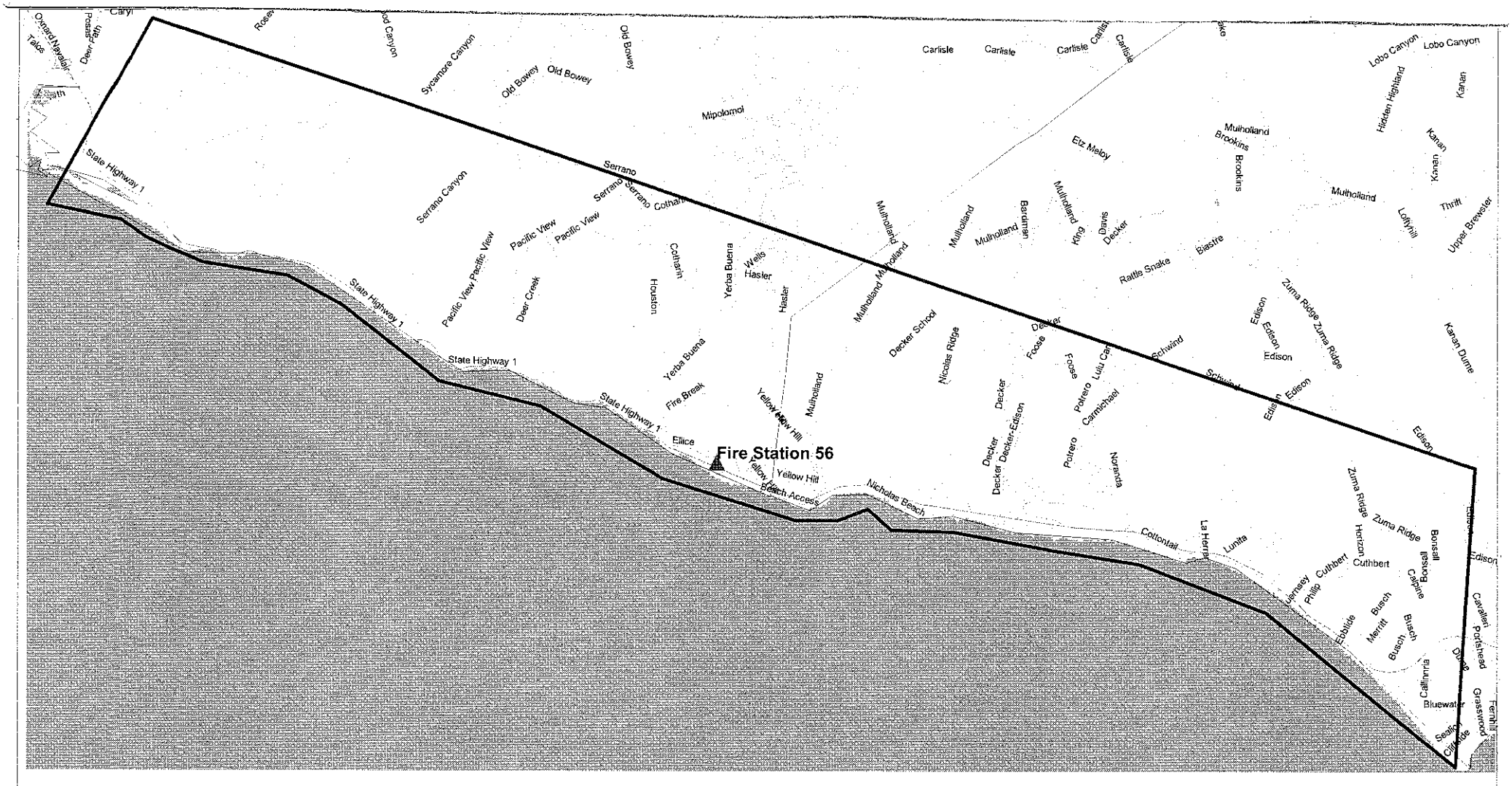
Tuesday, April 15 2008 3.20 Build 3355

Job Id : 547028913.5.000.1.11

Portion(s) Of GIS Source Data Provided By ESRI, Inc.

MOTOROLA

Ventura County Fire Protection District
Study of RF Communications—New Fire Station 56
Deliverable 3—Draft Statement of Needs and Alternatives
Attachment E – FS 56 Operational Area



44 Square Miles

0 1.00 2.00 mi
1 inch = 1.00 miles @ 1/63360

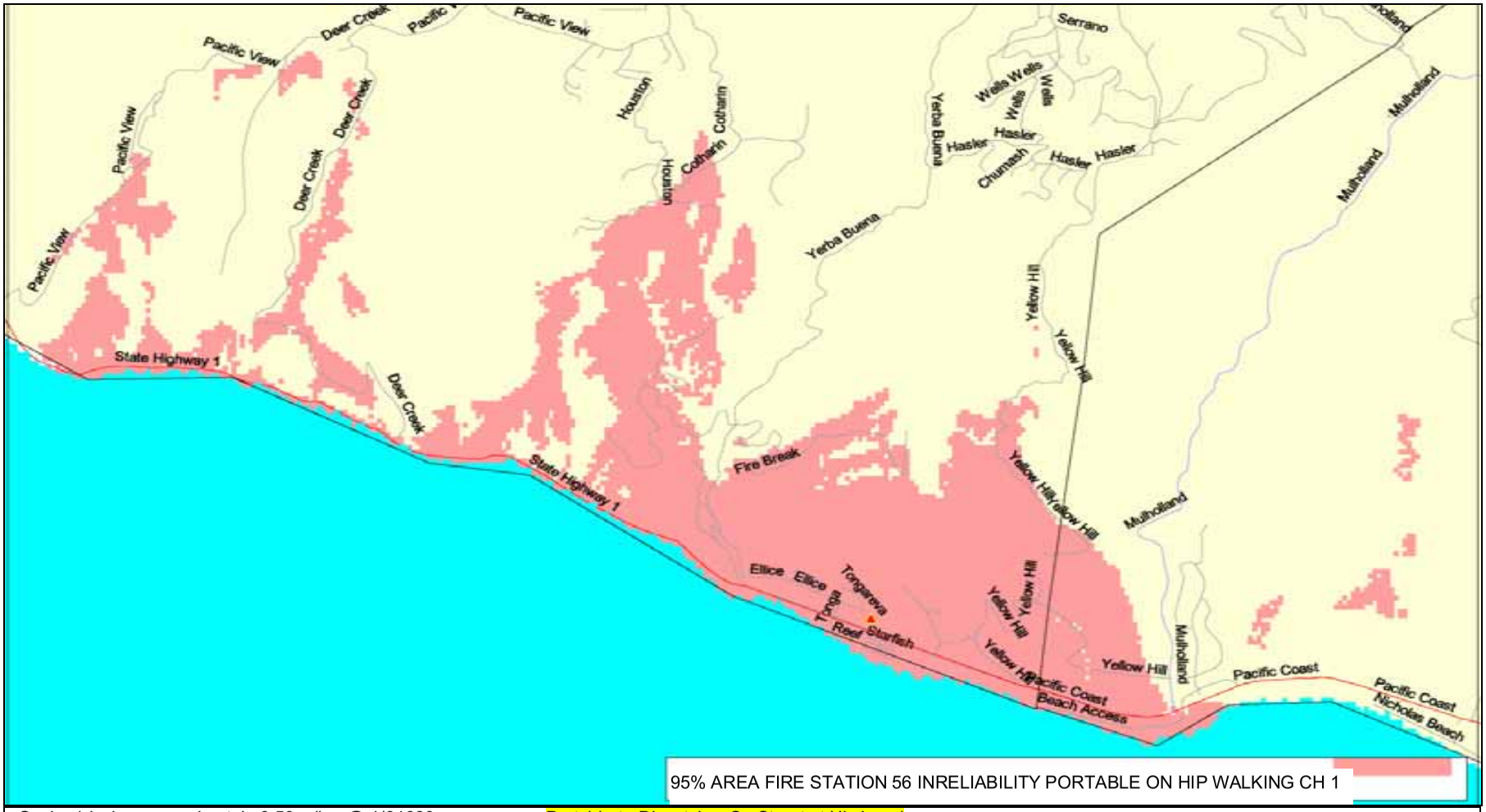
Monday, April 14 2008 3.20 Build 3355

Portion(s) Of GIS Source Data Provided By ESRI, Inc.

Job Id : 30894245.1.000.1.6

MOTOROLA

Ventura County Fire Protection District
Study of RF Communications—New Fire Station 56
Deliverable 3—Draft Statement of Needs and Alternatives
Attachment F, Map Set A (Inbound), FS 56 Area Command -- Rx Antenna at 100 Feet



Scale: 1 inch = approximately 0.50 miles @ 1/31680

Portable-to-Dispatcher On Street at Hip Level

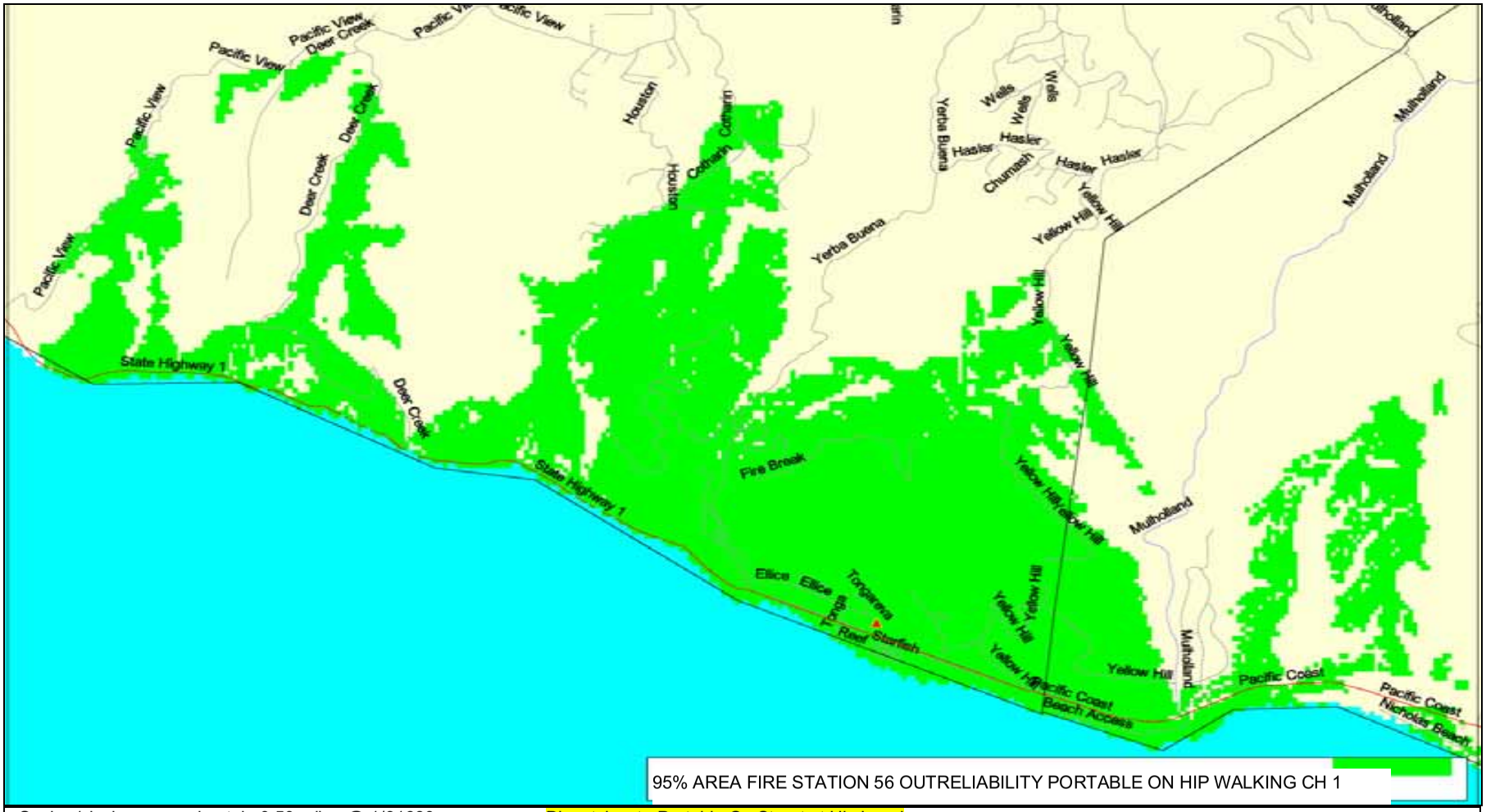
Monday, April 14 2008 3.20 Build 3355

Job Id : 5552215.1.000.1.3

Portion(s) Of GIS Source Data Provided By ESRI, Inc.

MOTOROLA

Ventura County Fire Protection District
Study of RF Communications—New Fire Station 56
Deliverable 3—Draft Statement of Needs and Alternatives
Attachment F, Map Set A (Outbound), FS 56 Area Command -- Tx Antenna at 77 Feet



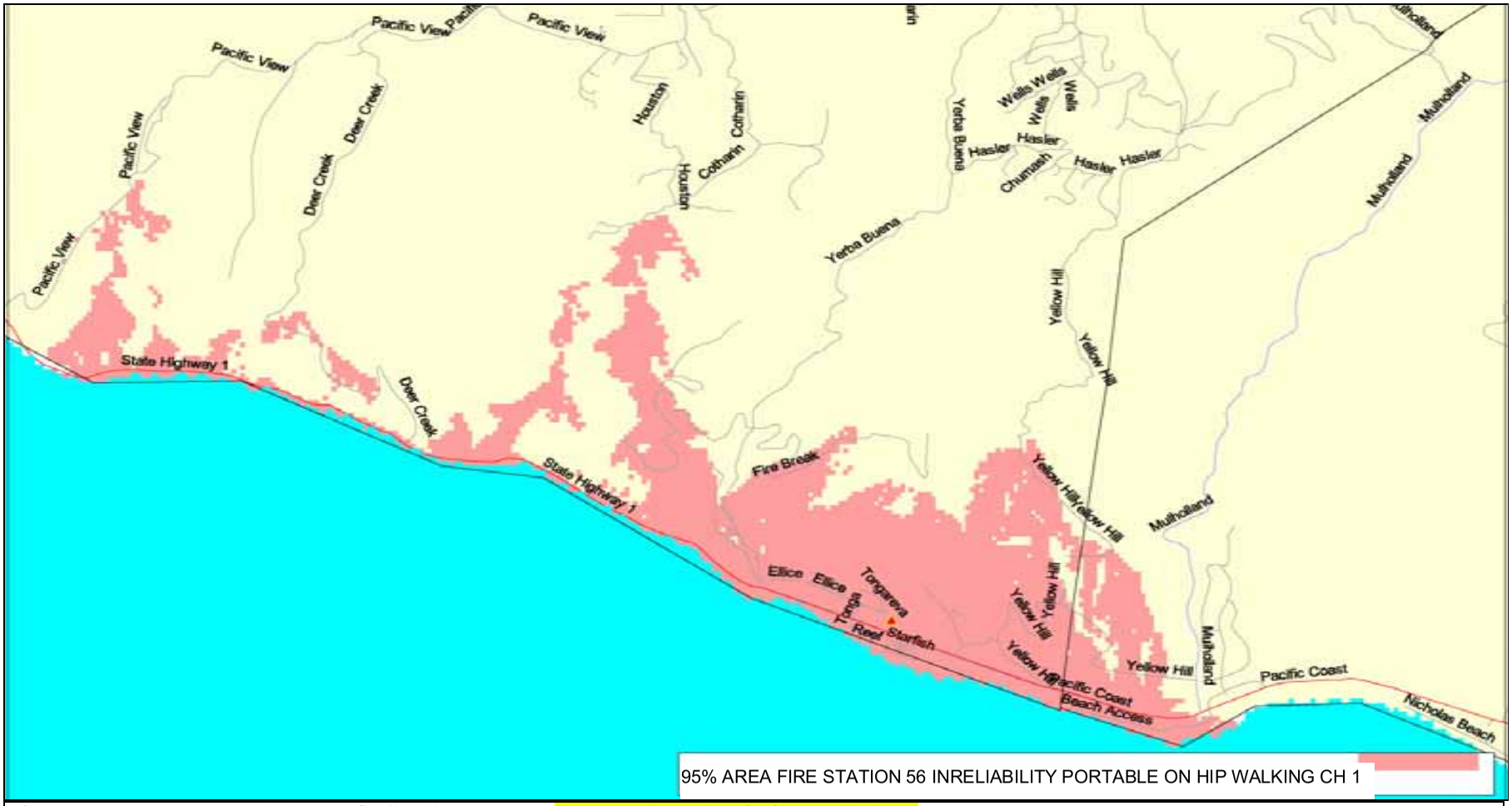
Scale: 1 inch = approximately 0.50 miles @ 1/31680 Dispatcher-to-Portable On Street at Hip Level

Monday, April 14 2008 3.20 Build 3355 Job Id : 5552215.1.000.1.3

Portion(s) Of GIS Source Data Provided By ESRI, Inc.

MOTOROLA

Ventura County Fire Protection District
Study of RF Communications—New Fire Station 56
Deliverable 3—Draft Statement of Needs and Alternatives
Attachment F, Map Set B (Inbound), FS 56 Area Command -- Rx Antenna at 55 Feet



Scale: 1 inch = approximately 0.50 miles @ 1/31680

Portable-to-Dispatcher On Street at Hip Level

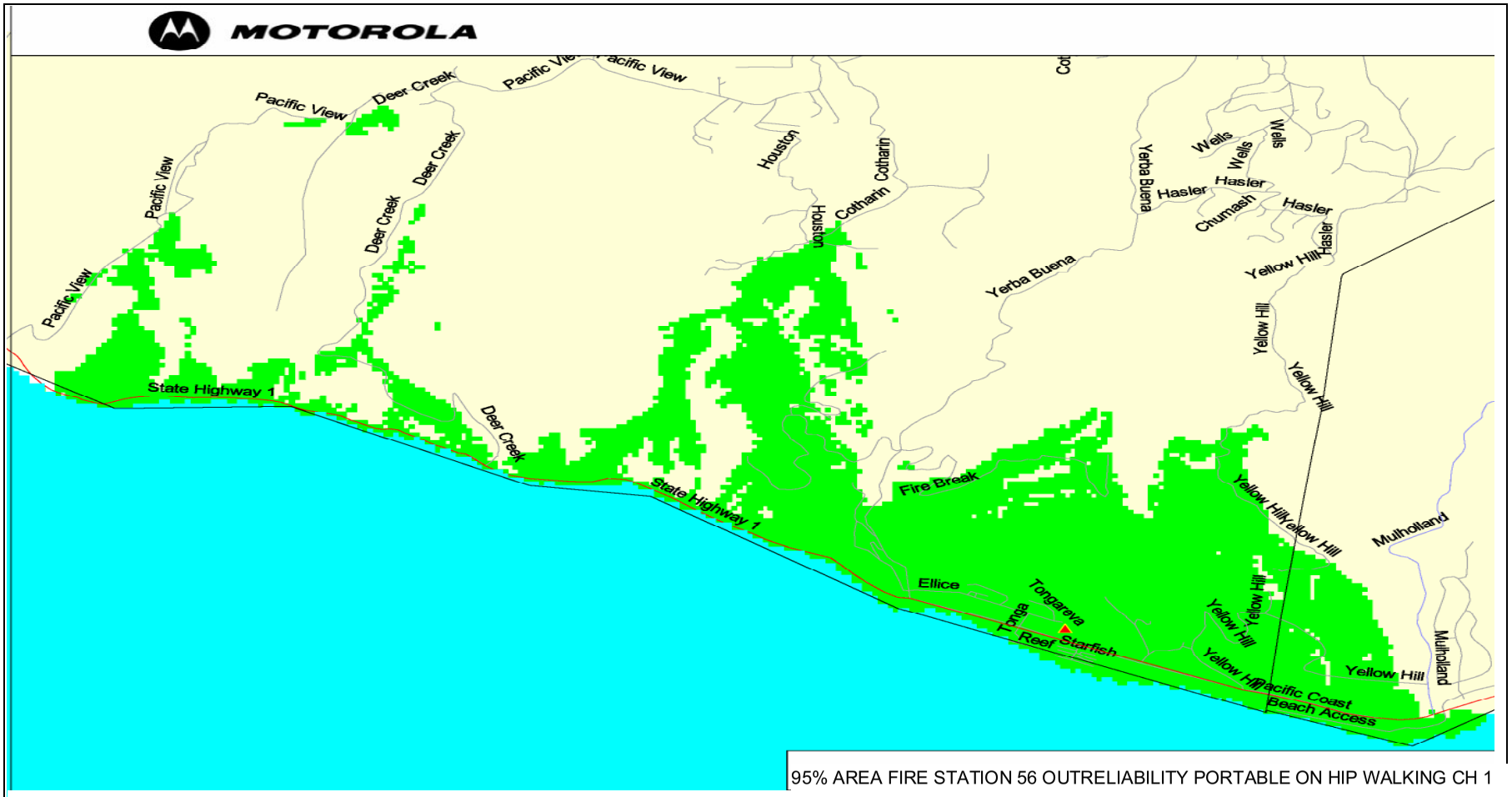
Monday, April 14 2008 3.20 Build 3355

Job Id : 764627120.1.000.1.4

Portion(s) Of GIS Source Data Provided By ESRI, Inc.

MOTOROLA

Ventura County Fire Protection District
Study of RF Communications—New Fire Station 56
Deliverable 3—Draft Statement of Needs and Alternatives
Attachment F, Map Set B (Outbound), FS 56 Area Command -- Tx Antenna at 32 Feet



Scale: 1 inch = approximately 0.50 miles @ 1/31680

Dispatcher-to-Portable On Street at Hip Level

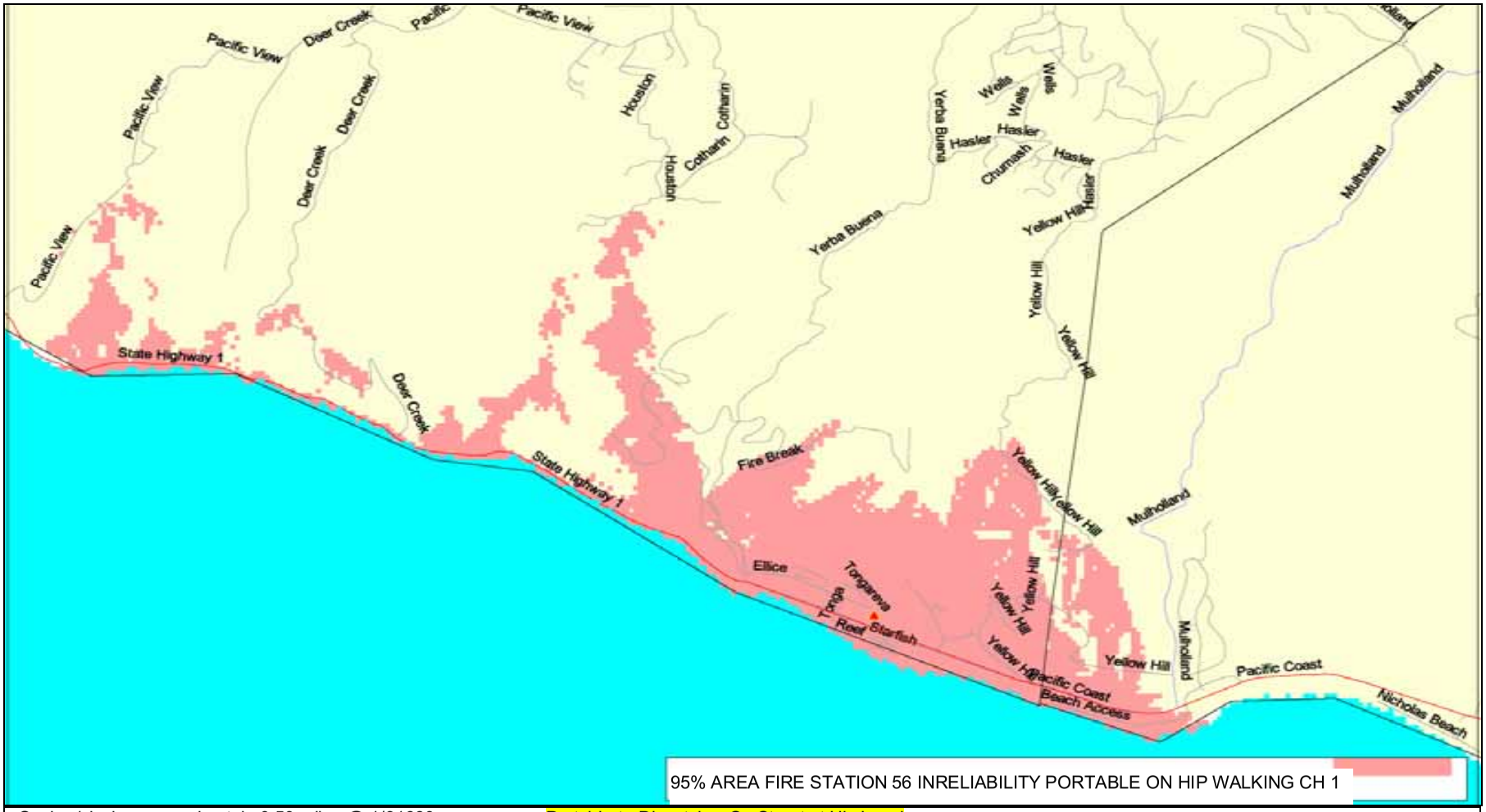
Monday, April 14 2008 3.20 Build 3355

Job Id : 764627120.1.000.1.4

Portion(s) Of GIS Source Data Provided By ESRI, Inc.

MOTOROLA

Ventura County Fire Protection District
Study of RF Communications—New Fire Station 56
Deliverable 3—Draft Statement of Needs and Alternatives
Attachment F, Map Set C (Inbound), FS 56 Area Command -- Rx Antenna at 50 Feet



Scale: 1 inch = approximately 0.50 miles @ 1/31680 Portable-to-Dispatcher On Street at Hip Level

Monday, April 14 2008 3.20 Build 3355 Job Id : 2425931558.1.000.1.5

Portion(s) Of GIS Source Data Provided By ESRI, Inc.

MOTOROLA

Ventura County Fire Protection District
Study of RF Communications—New Fire Station 56
Deliverable 3—Draft Statement of Needs and Alternatives
Attachment F, Map Set C (Outbound), FS 56 Area Command -- Tx Antenna at 27 Feet

Scale: 1 inch = approximately 0.50 miles @ 1/31680

Dispatcher-to-Portable On Street at Hip Level

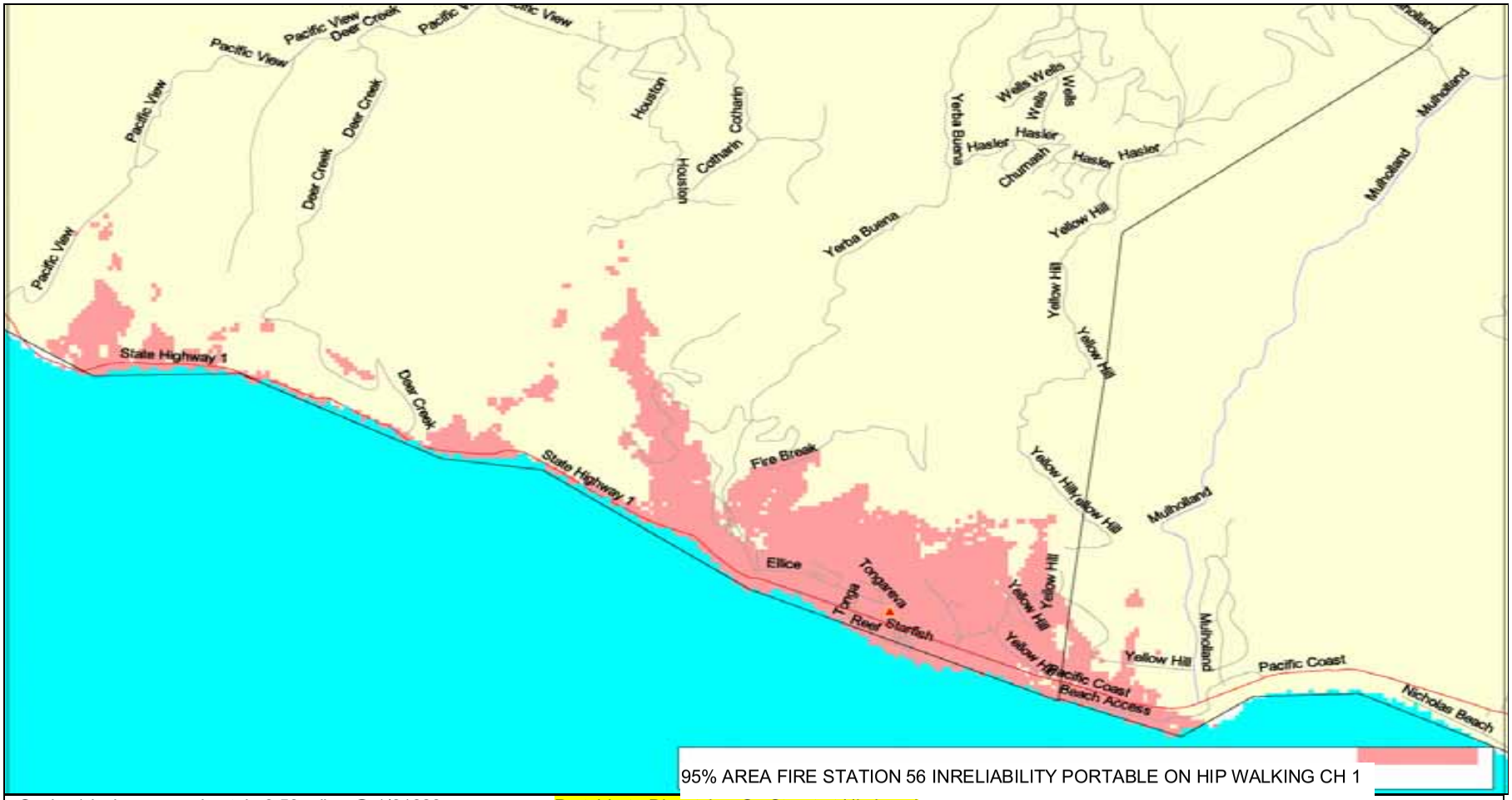
Monday, April 14 2008 3.20 Build 3355

Job Id : 2425931558.1.000.1.5

Portion(s) Of GIS Source Data Provided By ESRI, Inc.

MOTOROLA

Ventura County Fire Protection District
Study of RF Communications—New Fire Station 56
Deliverable 3—Draft Statement of Needs and Alternatives
Attachment F, Map Set D (Inbound), FS 56 Area Command -- Rx Antenna at 28 Feet



Scale: 1 inch = approximately 0.50 miles @ 1/31680

Portable-to-Dispatcher On Street at Hip Level

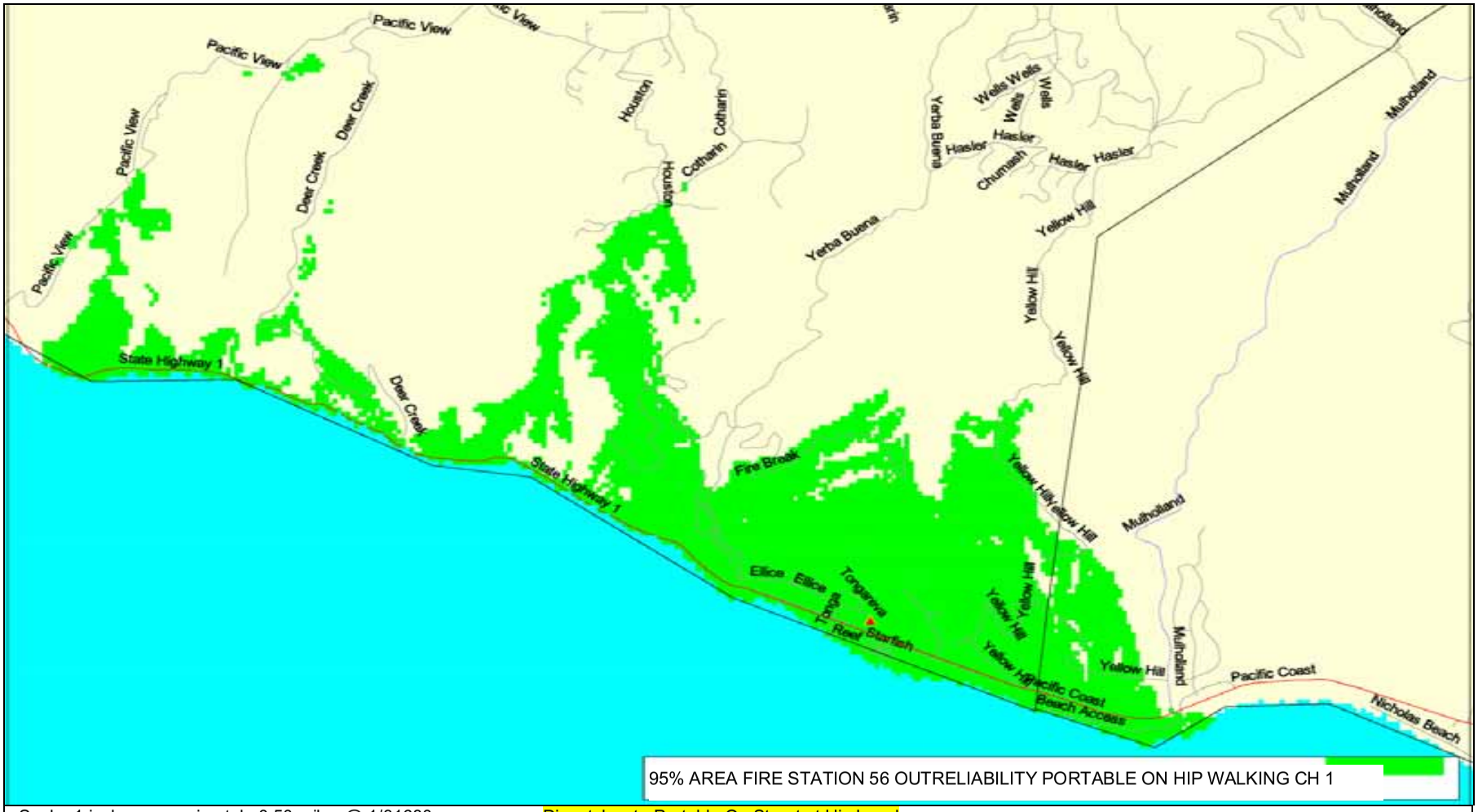
Monday, April 14 2008 3.20 Build 3355

Job Id : 30894245.1.000.1.6

Portion(s) Of GIS Source Data Provided By ESRI, Inc.

MOTOROLA

Ventura County Fire Protection District
Study of RF Communications—New Fire Station 56
Deliverable 3—Draft Statement of Needs and Alternatives
Attachment F, Map Set D (Outbound), FS 56 Area Command -- Tx Antenna at 28 Feet



Scale: 1 inch = approximately 0.50 miles @ 1/31680

Dispatcher-to-Portable On Street at Hip Level

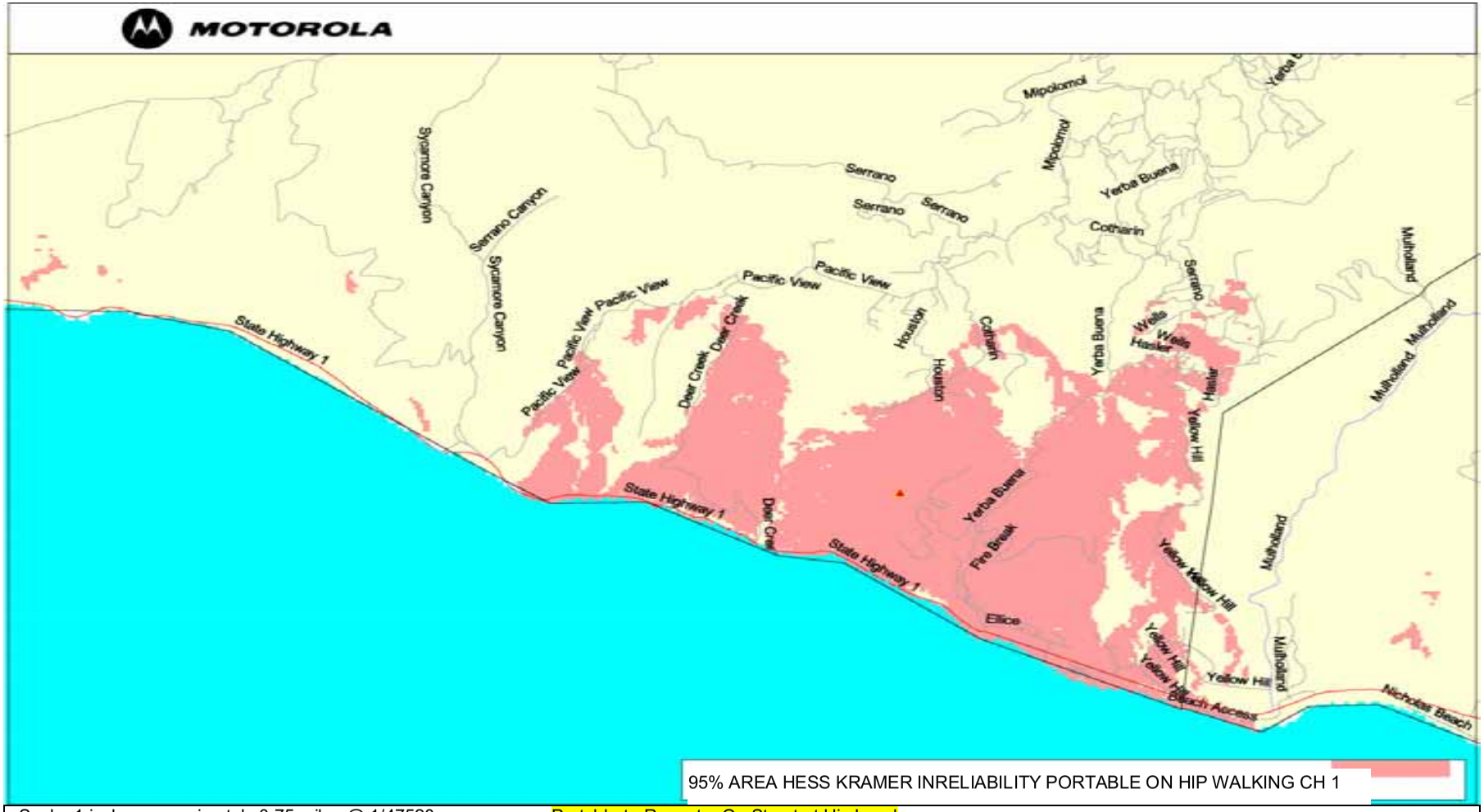
Monday, April 14 2008 3.20 Build 3355

Job Id : 30894245.1.000.1.6

Portion(s) Of GIS Source Data Provided By ESRI, Inc.

MOTOROLA

Ventura County Fire Protection District
Study of RF Communications—New Fire Station 56
Deliverable 3—Draft Statement of Needs and Alternatives
Attachment G -- Hess Kramer Portable to Repeater Inbound



Scale: 1 inch = approximately 0.75 miles @ 1/47520

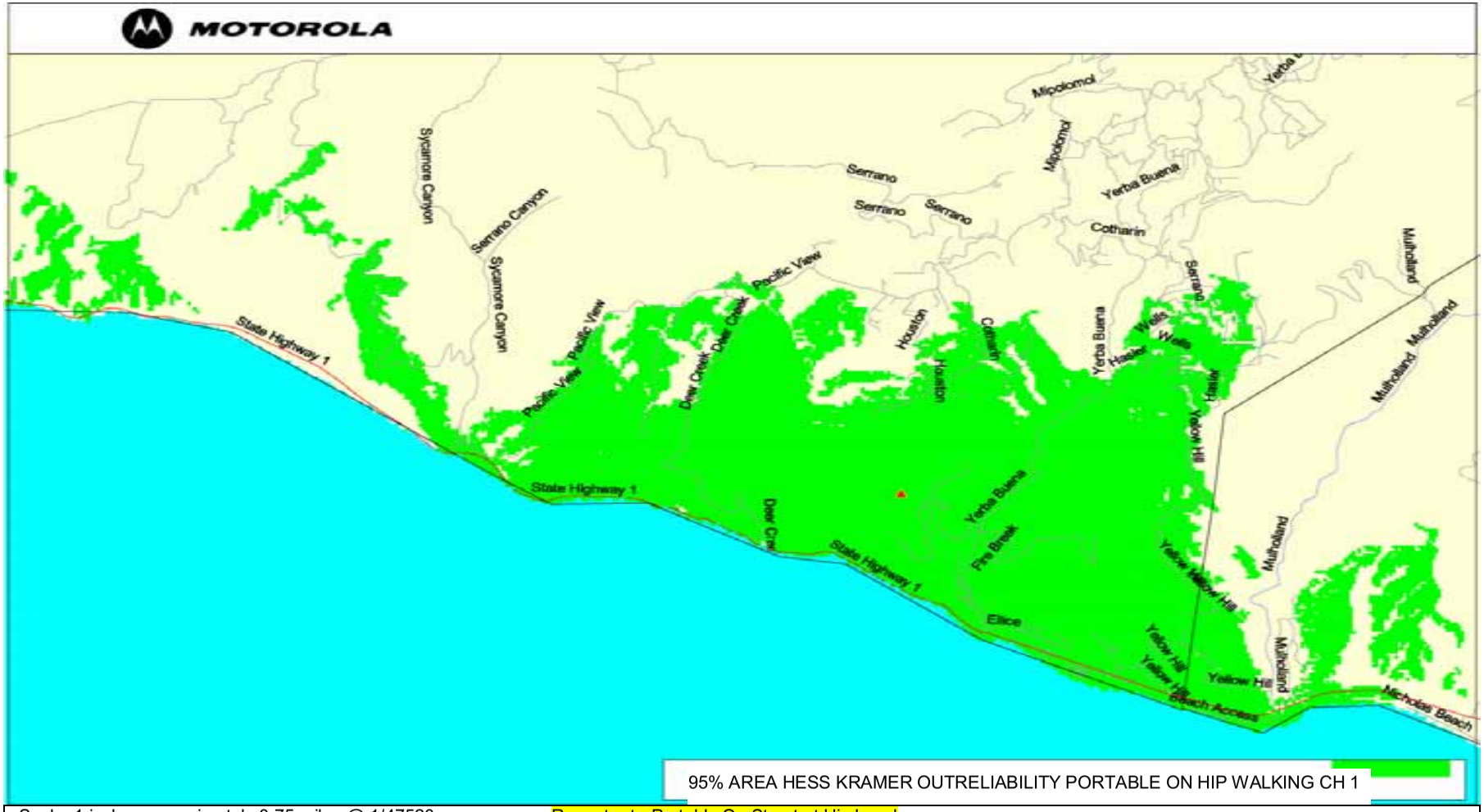
Portable-to-Repeater On Street at Hip Level

Tuesday, April 15 2008 3.20 Build 3355

Job Id : 3223027437.1.000.1.2

Portion(s) Of GIS Source Data Provided By ESRI, Inc.

Ventura County Fire Protection District
Study of RF Communications—New Fire Station 56
Deliverable 3—Draft Statement of Needs and Alternatives
Attachment G -- Hess Kramer Repeater to Portable Outbound



Scale: 1 inch = approximately 0.75 miles @ 1/47520

Repeater-to-Portable On Street at Hip Level

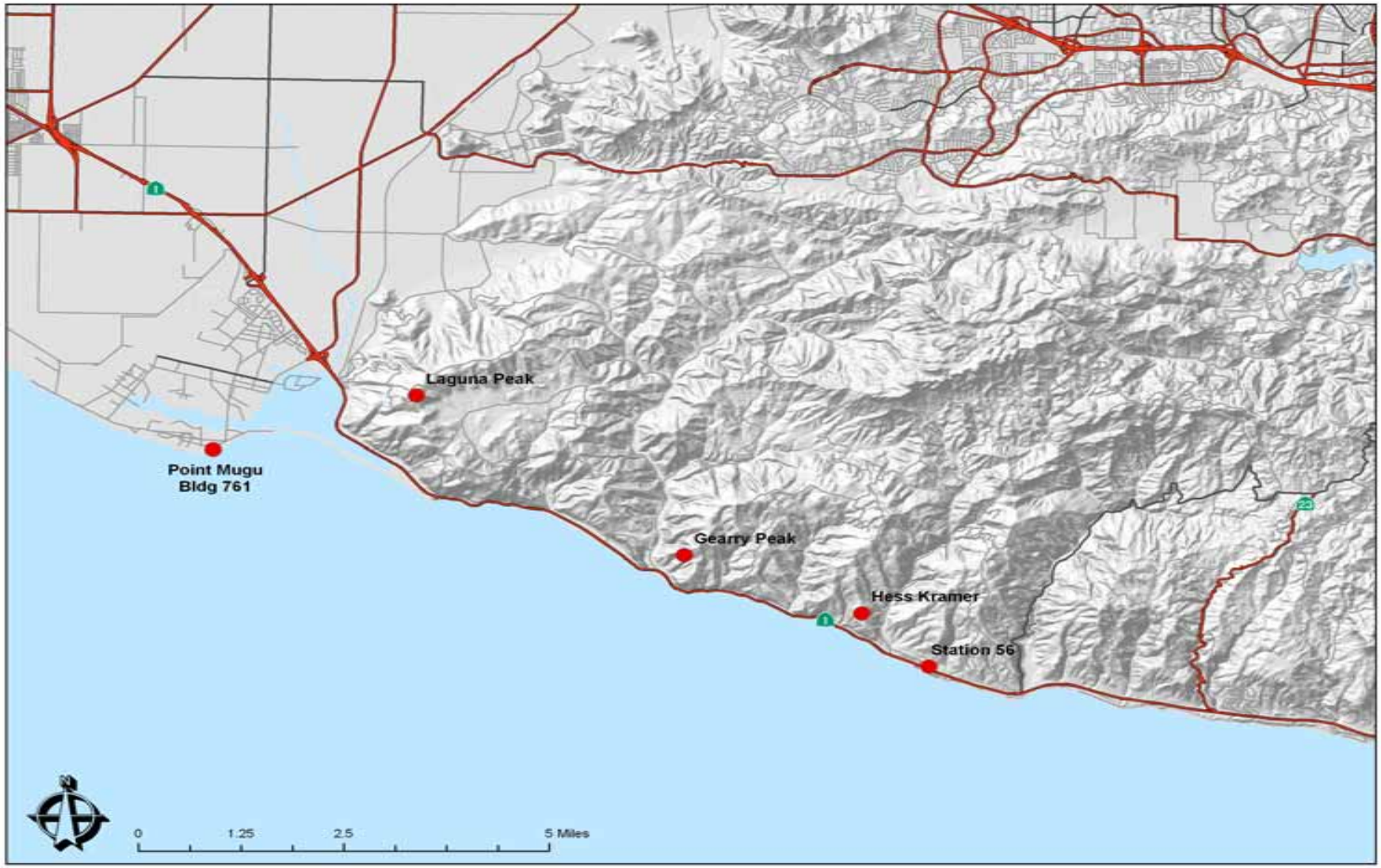
Tuesday, April 15 2008 3.20 Build 3355

Job Id : 3223027437.1.000.1.2

Portion(s) Of GIS Source Data Provided By ESRI, Inc.

MOTOROLA

Ventura County Fire Protection District
Study of RF Communications—New Fire Station 56
Deliverable 3—Draft Statement of Needs and Alternatives
Attachment H – Radio Sites FS 56 Area



MOTOROLA

Ventura County Fire Protection District
Study of RF Communications—New Fire Station 56
Deliverable 3—Draft Statement of Needs and Alternatives
Attachment I – Photo Simulations of a 55 Foot Monopole at FS 56

June 2, 2008

Photosimulation of view looking south from the hillside above the new fire station.

© Copyright 2007, Previsualists Inc., all rights reserved. Accuracy of this photosimulation based upon information provided by project applicant. Questions? Call 1.877.799.3210 or visit WWW.PHOTOSIM.COM

Previsualists

MOTOROLA

Ventura County Fire Protection District
Study of RF Communications—New Fire Station 56
Deliverable 3—Draft Statement of Needs and Alternatives
Attachment I – Photo Simulations of a 55 Foot Monopole at FS 56

June 2, 2008

Photosimulation of view looking southeast from Tonga Street at Ellice Street.

© Copyright 2007. Previsualists Inc., all rights reserved. Accuracy of this photosimulation based upon information provided by project applicant. Questions? Call 1.877.799.3210 or visit WWW.PHOTOSIM.COM

Previsualists

MOTOROLA

Ventura County Fire Protection District
Study of RF Communications—New Fire Station 56
Deliverable 3—Draft Statement of Needs and Alternatives
Attachment I – Photo Simulations of a 55 Foot Monopole at FS 56

June 2, 2008

Photosimulation of view looking east along the PCH across from Neptunes Net.

© Copyright 2007. Previsualists Inc., all rights reserved. Accuracy of this photosimulation based upon information provided by project applicant. Questions? Call 1.877.799.3210 or visit WWW.PHOTOSIM.COM

Previsualists

MOTOROLA

Ventura County Fire Protection District
Study of RF Communications—New Fire Station 56
Deliverable 3—Draft Statement of Needs and Alternatives
Attachment I – Photo Simulations of a 55 Foot Monopole at FS 56

June 2, 2008

Photosimulation of view looking west from the PCH at E Whalers Lane.

© Copyright 2007. Previsualists Inc., all rights reserved. Accuracy of this photosimulation based upon information provided by project applicant. Questions? Call 1.877.799.3210 or visit WWW.PHOTOSIM.COM

Previsualists

Ventura County Fire Protection District

Study of RF Communications
Fire Station 56

Deliverable 4
Statement of Costs
Budgetary Estimate

MOTOROLA, INC.
Government and Public Safety
Enterprise Mobility Solutions

Revised 5-13-08

Data Restrictions

The information provided in this estimate is for informational (or budgetary) purposes only and does not constitute an offer to sell or license any Motorola product. It is not binding on Motorola and Motorola makes no representations, warranties, or commitments with respect to pricing, products, or terms and conditions, which would require more information and further detailed analysis of the requirements for which this estimate is requested.

This budgetary estimate is considered Motorola Confidential Restricted. It is submitted with the restriction that it is to be used for evaluation purposes only, and is not to be disclosed publicly or in any manner to anyone other than those employed by the County of Ventura Fire District required to evaluate this budgetary estimate without the express permission of Motorola.

May 13, 2008

Jim Norris – Information Technology Division
Ventura County Fire Department
165 Durley Avenue
Camarillo, CA 93010

Subject: Draft Statement Costs for Study of RF Communications for Fire Station 56

Dear Mr. Norris:

Thank you for allowing Motorola, Inc. ("Motorola") the opportunity to provide the Ventura County Fire Department with this draft budgetary estimate. This draft estimate is provided to further your consideration of Motorola products and services related to the Study of RF Communications for Fire Station 56.

The information in this estimate is provided to assist in your budget planning process. It is anticipated that Motorola will provide a final design and comprehensive proposal with firm pricing, based upon a more detailed analysis of the Fire Department's requirements.

As the industry's premier supplier of radio and integrated solutions, we believe Motorola possesses many unique capabilities. It is these capabilities over the years, which have allowed us to offer our customers effective solutions to their complex business problems. Motorola's primary goal is to provide solutions that help our customers improve the safety level of their employees and citizens. Simultaneously, we are committed to contributing to increased productivity and organizational profitability, while always ensuring customer satisfaction.

Should you have any questions, please do not hesitate to contact me at 805-966-7808, or Lee Threlkeld at 619-850-3731. Thank you for your consideration of this budgetary estimate.

Sincerely,

MOTOROLA, INC.

David Burton
Account Manager
Government and Public Safety

INTRODUCTION

Motorola builds, markets, and sells products, services, and applications that make simple and seamless connections to people, information and entertainment possible through broadband, embedded systems, and wireless networks. Our vision is to provide cutting-edge technologies that empower mobile consumers to go anywhere and do anything without sacrificing connectivity. This is seamless mobility.

Motorola is the leading provider of wireless communications systems and services for government, enterprise and commercial mobile service providers around the world. We deliver high-availability network infrastructure systems to commercial service providers and mission-critical end-to-end wireless communication networks, primarily for the government and public safety markets. Through our enterprise product portfolio, we deliver leading-edge mobile computing, mobile office and enterprise product network solutions. We are also an industry leader in the development of next-generation IP wireless broadband mobility technologies, offering an entire suite of end-to-end WiMAX infrastructure and customer premises equipment products. In addition, we offer a family of point-to-point and point-to-multipoint wireless broadband products to serve WiFi and wireless DSL operators.

With over 75 years of experience, Motorola offers a unique combination of innovative technology, extensive market experience, and the ability to design, integrate, and seamlessly implement the various technologies County of Ventura Fire District needs today and in the future. As the recipient of the 1988 and 2002 prestigious Malcolm Baldrige National Quality Award, the nation's premier award for performance excellence and quality achievement, Motorola has the resources and unmatched experience to help you address your unique situation in order to create a total solution that is right for you.

This budgetary estimate, presented for your consideration, is intended to assist you with defining your project funding requirements, as well as your solutions requirements for equipment and services. Upon request, your Motorola Account Executive will provide a detailed proposal with firm pricing that is tailored to your specific needs, which will include verification of all assumptions relative to unknowns that are contained within this budgetary estimate.

SYSTEM OVERVIEW

The County of Ventura Fire District, as part of the project to conduct a Study of RF Communications for the Fire Station 56 Operational Area, has requested costs for the optimum combination of an antenna tower at the new Fire Station 56 and alternatives to improve communications within the Fire Station 56 operational area.

Motorola has developed a budgetary estimate to identify the costs (equipment and services) to support the Fire District's three operational requirements as outlined below.

I. Fire Station Alerting and VHF Radio Base Station for Area Command

As described in Section III of this report, these critical operational requirements require the installation of an Area Command radio base station transceiver at Fire Station 56, a fifty-five foot monopole and associated antenna systems.

II. VHF Radio Repeaters

The Hess Kramer Water Tank site was identified as an alternative VHF repeater site to support the Fire District's requirement for enhanced portable-to-portable communications within the FS56 operational area. Motorola recommends the installation of a 12'X10' communications building, a fifty-five foot monopole, an RF repeater station and associated antenna systems.

III. VHF Receiver Voting System

During the RF testing process, alternative sites were considered and identified to support the VHF Receiver Voting System for dispatch and command communications.

In addition to the current dispatch channel voting receiver site at Point Mugu, coverage modeling has identified additional receiver sites to support both the Dispatch and Command channel operational requirements for voting receiver operation.

Motorola recommends the installation of a primary voting receiver at Fire Station 56, which will provide enhanced reliability in conjunction with the existing Point Mugu voting receiver, the future Laguna Peak voting receiver, and the alternative voting receiver sites of Hess Kramer Water Tank, and Gearry Hill.

Here is a brief overview of the work to be performed at each site. Also refer to the attached Statement of Work documents for Fire Station 56 and Hess Kramer Water Tank which describes the civil work associated with the installation of the monopoles and the communications building at the Hess Kramer Water Tank. A budgetary equipment list is included at the end of this section.

Fire Station 56

1. Provide and install a 55 foot monopole
2. Install one Quantar base station, two Quantar voting receivers and a receiver multicoupler in the Fire Station equipment room.
3. Install one 5.5 dB Stationmaster omni antenna and transmission line at the top of the monopole
4. Install four antennas (two 3 dB VHF omni, unity Gain UHF omni, and unity gain 800 MHz omni) and transmission lines at the 32 foot level of the monopole.
5. Perform standard RF equipment programming and optimization and document results. Include site, tower and rack-face drawings.
6. Perform antenna sweeps and document results.
7. Interface voting receivers with the comparators at the Fire District Dispatch Center via Fire District-provided dedicated wireline circuits and set levels.
8. Conduct a functional ATP demonstrating basic equipment operation.

Hess Kramer Water Tank

1. Provide and install a 55 foot monopole
2. Install a Motorola Standard Building (12'X10')
3. Install one Quantar repeater station, two Quantar voting receivers and a receiver multicoupler in the standard building.
4. Install one 5.5 dB Stationmaster omni antenna and transmission line at the top of the monopole.
5. Install two antennas (3 dB VHF) and transmission lines at the 32 foot level of the monopole.
6. Perform standard RF equipment programming and optimization and document results. Include site, tower and rack-face drawings.
7. Perform antenna sweeps and document results.
8. Interface voting receivers with the comparators at the Fire District Dispatch Center via Fire District-provided dedicated wireline circuits and set levels.
9. Conduct a functional ATP demonstrating basic equipment operation.

Gearry Hill Site

1. Install two Quantar voting receivers and a receiver multicoupler in the site equipment room.
2. Install one 5.5 dB Stationmaster omni antenna and transmission line at the top of the site's existing tower.
3. Install the Canopy 2.4 GHz link equipment to support a path from here to the Laguna Peak site.

4. Install the Solar Array on a Motorola-provided pole, and the solar array support equipment (inverter and batteries) and interface to the voting receivers, multi-coupler and Canopy equipment.
5. Perform standard RF equipment programming and optimization and document results. Include site, tower, and rack-face drawings.
6. Perform antenna sweeps and document results.
7. Interface the voting receivers with the comparators at the Fire District Dispatch Center via the Canopy backhaul link and County microwave link and set levels.
8. Conduct a functional ATP demonstrating basic equipment operation.
9. Conduct a Canopy link test and document the results.

Laguna Peak Site

1. Install the Canopy 2.4 GHz link equipment to support a path from here to the Gearry Hill site.

Budgetary Equipment List

Location	Num	Qty	Nomenclature	Description
FS56	1	1	C99ED	QUANTAR/QUANTRO FAMILY
FS56	1a	1	001C	QUANTAR STATION
FS56	1b	1	X597 A	ENH: CONVENTIONAL ANALOG OPERATION
FS56	1c	1	X530	ADD: 125W QUANTAR, VHF (132-1 74MHZ)
FS56	1d	1	X873	ADD: INTERAL UHSO TO QUANTAR/QUANTR
FS56	1e	1	X182	ADD: FACTORY INSTALLED DUPLEXER, VH
FS56	1f	1	X676	ADD: CIRC, TRIPLE
FS56	1g	1	X696	ADD: TRAY, PERIPHERAL FOR QUANTAR
FS56	1h	1	X407AA	120V AC POWER STRIP 4 OUTLET
FS56	1i	1	X330	ADD: 25W QUANTAR, VHF (132-1 74MHZ)
FS56	1j	1	X832	ADD: 7' OPEN RACK-QUANTAR
FS56	2	2	T5367	ASTRO SATELLITE QUANTAR RECEIVER
FS56	2a	2	X319	ADD: RECEIVER, VHF
FS56	2b	2	X269	ENH: SPECTRA TAC CONVENTIONAL
FS56	2c	2	X153	ADD: HARDWARE, RACKMOUNT
FS56	2d	2	X873	ADD: INTERAL UHSO TO QUANTAR/QUANTR
FS56	2e	2	X597	ENH: CONVENTIONAL RECEIVER
FS56	3	1	TDD6074	ANTENNA 157-165MHZ OMNI 5.25DB, N C
FS56	4	1	TDD7570	ANTENNA 149-155 MHZ GAIN 3DB L 9.2'
FS56	5	1	TDE7190	ANTENNA 406-470MHZ OMNI 0DB
FS56	6	1	TDF6481	ANTENNA 800 OMNI NFE UNITY GAIN, 80
FS56	7	1	TDD6970	RECEIVER MULTICOUPLER 4 RECEIVER
FS56	8	300	L3323	7/8" AVA HELIAX POLY JKT PER FOOT
FS56	9	16	DDN9496	7-16 DIN FEMALE PS CONNECTOR

Motorola Confidential Restricted
Use or disclosure of this budgetary proposal is subject to the restrictions on the title page.

Location	Num	Qty	Nomenclature	Description
FS56	10	8	TDN6674	5/8" - 7/8" CABLE GROUND CLAMP KIT
FS56	11	50	L1702	1/2" SUPERFLEX POLY JKT PER FOOT
FS56	12	50	L1700	1/4" SUPERFLEX POLY JKT PER FOOT
FS56	13	6	TDN9715	1/4" CONN BNC MALE S FLEX PLTD
FS56	14	6	CDN6579	1/2" N MALE PLATED CONNECTOR
FS56	15	1	TDN9588	WALL ROOF FEED THRU PLATE 8 ENTRY
FS56	16	4	RRX4021	LGTNG/SURGE ARRESTOR
FS56	17	1	DSOP820B	POWER DIST. UNIT SURGE PROTECT
FS56	18	1	MONOPOLE 55 FEET	Monopole
Hess Kramer	19	1	C99ED	QUANTAR/QUANTRO FAMILY
Hess Kramer	19a	1	001C	QUANTAR STATION
Hess Kramer	19b	1	X597 A	ENH: CONVENTIONAL ANALOG OPERATION
Hess Kramer	19c	1	X530	ADD: 125W QUANTAR, VHF (132-174MHZ)
Hess Kramer	19d	1	X873	ADD: INTERAL UHSO TO QUANTAR/QUANTR
Hess Kramer	19e	1	X182	ADD: FACTORY INSTALLED DUPLEXER, VH
Hess Kramer	19f	1	X676	ADD: CIRC, TRIPLE
Hess Kramer	19g	1	X696	ADD: TRAY, PERIPHERAL FOR QUANTAR
Hess Kramer	19h	1	X580	ADD: REPEATER OPERATION
Hess Kramer	19i	1	X832	ADD: 7' OPEN RACK-QUANTAR
Hess Kramer	20	2	T5367	ASTRO SATELLITE QUANTAR RECEIVER
Hess Kramer	20a	2	X319	ADD: RECEIVER, VHF
Hess Kramer	20b	2	X269	ENH: SPECTRA TAC CONVENTIONAL
Hess Kramer	20c	2	X153	ADD: HARDWARE, RACKMOUNT
Hess Kramer	20d	2	X873	ADD: INTERAL UHSO TO QUANTAR/QUANTR
Hess Kramer	20e	2	X597	ENH: CONVENTIONAL RECEIVER
Hess Kramer	21	1	TDD6074	ANTENNA 157-165MHZ OMNI 5.25DB, N C
Hess Kramer	22	1	TDD7570	ANTENNA 149-155 MHZ GAIN 3DB L 9.2'
Hess Kramer	23	1	TDD6970	RECEIVER MULTICOUPLER 4 RECEIVER

Motorola Confidential Restricted
Use or disclosure of this budgetary proposal is subject to the restrictions on the title page.

Location	Num	Qty	Nomenclature	Description
Hess Kramer	24	250	L3323	7/8" AVA HELIAX POLY JKT PER FOOT
Hess Kramer	25	4	DDN9496	7-16 DIN FEMALE PS CONNECTOR
Hess Kramer	26	4	TDN6674	5/8" - 7/8" CABLE GROUND CLAMP KIT
Hess Kramer	27	20	L1 702	1/2" SUPERFLEX POLY JKT PER FOOT
Hess Kramer	28	20	L1 700	1/4" SUPERFLEX POLY JKT PER FOOT
Hess Kramer	29	4	TDN9715	1/4" CONN BNC MALE S FLEX PLTD
Hess Kramer	30	4	CDN6579	1/2" N MALE PLATED CONNECTOR
Hess Kramer	31	2	RRX4021	LGTNG/SURGE ARRESTOR
Hess Kramer	32	1	DSOP820B	POWER DIST. UNIT SURGE PROTECT
Hess Kramer	33	1	MONOPOLE 55 FEET	Monopole
Hess Kramer	34	1	TT1004	MSB, 12' X 10' IR BLDG, INCLS UPS
Hess Kramer	34a	1	TT04020AA	ADD: SIESMIC RATING 51%-185%G ONLY
Gearry Hill	35	2	T5367	ASTRO SATELLITE QUANTAR RECEIVER
Gearry Hill	35a	2	X319	ADD: RECEIVER, VHF
Gearry Hill	35b	2	X269	ENH: SPECTRA TAC CONVENTIONAL
Gearry Hill	35c	2	X153	ADD: HARDWARE, RACKMOUNT
Gearry Hill	35d	2	X873	ADD: INTERAL UHSO TO QUANTAR/QUANTR
Gearry Hill	35e	2	X597	ENH: CONVENTIONAL RECEIVER
Gearry Hill	36	1	TDD6074	ANTENNA 157-165MHZ OMNI 5.25DB, N C
Gearry Hill	37	1	TDD6970	RECEIVER MULTICOUPLER 4 RECEIVER
Gearry Hill	38	140	L3323	7/8" AVA HELIAX POLY JKT PER FOOT
Gearry Hill	39	16	DDN9496	7-16 DIN FEMALE PS CONNECTOR
Gearry Hill	40	8	TDN6674	5/8" - 7/8" CABLE GROUND CLAMP KIT
Gearry Hill	41	50	L1 702	1/2" SUPERFLEX POLY JKT PER FOOT
Gearry Hill	42	50	L1 700	1/4" SUPERFLEX POLY JKT PER FOOT
Gearry Hill	43	6	TDN9715	1/4" CONN BNC MALE S FLEX PLTD
Gearry Hill	44	6	CDN6579	1/2" N MALE PLATED CONNECTOR
Gearry Hill	45	1	TDN9588	WALL ROOF FEED THRU PLATE 8 ENTRY
Gearry Hill	46	4	RRX4021	LGTNG/SURGE ARRESTOR
Gearry Hill	47	1	DSOP820B	POWER DIST. UNIT SURGE PROTECT
Gearry Hill	48	5	DSSW120	Solar Array
Gearry Hill	49	10	DSPV-1040T	120 A/H Battery

Motorola Confidential Restricted
Use or disclosure of this budgetary proposal is subject to the restrictions on the title page.

Location	Num	Qty	Nomenclature	Description
Gearry Hill	50	1	DSDA1 1000L-12-1-A	AC Inverter for Solar Array
Gearry Hill	51	1	2401 BHRFBC	ASSY,ASSY,2.4 GHZ 10 MBPS BKHAUL KI
Gearry Hill	52	1	200SSB	ASSY,SRG PROT,SURGE SUPR FOR CMM PW
Gearry Hill	53	1	RRDN4417	IPMUX-1E/AC/4E&M/UTP,4E&M CARD - IP
Laguna Peak	54	1	2401 BHRFBC	ASSY,ASSY,2.4 GHZ 10 MBPS BKHAUL KI
Laguna Peak	55	1	200SSB	ASSY,SRG PROT,SURGE SUPR FOR CMM PW
Laguna Peak	56	1	RRDN4417	IPMUX-1E/AC/4E&M/UTP,4E&M CARD - IP

SERVICES

Professional Integration Services

To ensure a smooth installation and deployment, this budgetary estimate includes the following services:

- Includes Project Management for system installation and optimization.
- Includes Field Engineering support for system installation and optimization.
- Includes system installation and optimization.
- Please refer to the attached Statement of Work documents for Fire Station 56 and Hess Kramer Water Tank which describes the civil work associated with the installation of the monopoles and the communications building at the Hess Kramer Water Tank.

This solution will be installed, optimized, and tested by our dedicated Project Implementation Team.

Motorola System Support

Motorola's standard warranty covers on-site response during normal business hours and provides for the repair or replacement of defective hardware components.

ASSUMPTIONS

Motorola has made several assumptions in preparing this budgetary estimate, which are noted below. In order to provide a firm quote, Motorola will need to verify all assumptions or seek alternate solutions in the case of invalid assumptions.

- All existing sites or equipment locations will have sufficient space available for the system described.
- All existing sites or equipment locations will have adequate electrical power and site grounding to support the requirements of the system described.
- All existing towers will have adequate space and size to support the antenna network requirements of the system described.
- Any site/location upgrades or modifications other than those identified in the attached Statement of Work documents are the responsibility of the Fire District
- Any tower stress analysis or tower upgrade requirements are the responsibility of the Fire District.
- Approved FCC licensing provided by the Fire District.
- Approved local, State or Federal permits as may be required for the installation and operation of the proposed equipment are the responsibility of the Fire District.
- Any required system interconnections not specifically outlined here will be provided by the Fire District. These may include dedicated phone circuits or microwave links.
- Where necessary, the Fire District will provide a dedicated delivery point, such as a warehouse, for receipt, inventory and storage of equipment prior to delivery to the sites.

Motorola Confidential Restricted
Use or disclosure of this budgetary proposal is subject to the restrictions on the title page.

ADDITIONAL EQUIPMENT AND SERVICES AVAILABLE UPON REQUEST

The following is a summary of equipment and services that Motorola will quote separately, upon request.

- Site Connectivity
- Site acquisition or preparation costs, such as buildings, towers, grounding, or licenses / permits or costs to upgrade sites to comply with the Motorola document "Standards and Guidelines for Communications Sites"
- Site power generation or utility costs such as electrical power terminations, generators, battery chargers, back-up battery banks, etc.
- Customizes service package based upon Fire District-specific requirements
- Coverage Prediction and Testing
- Microwave Maintenance
- Security Remediation
- Subscriber Repair Services and Upgrades
- Lifecycle System Management Services
- Fire District Training (http://www.motorola-wls.com)
- Applicable Federal, State, and local taxes

Motorola Confidential Restricted
Use or disclosure of this budgetary proposal is subject to the restrictions on the title page.

BUDGETARY ESTIMATE

Motorola's budgetary estimate pricing was redacted in the version of this document to be made public by the Ventura County Fire Protection District.

Estimate Detail

Fire Station 56	
55 Foot Monopole	$
Fixed Network Equipment	$
Hess Kramer Water Tank	
55 Foot Monopole	$
Standard Building (12'X10')	$
Fixed Network Equipment	$
Gearry Hill Site	
Fixed Network Equipment	$
Laguna Peak Site	
Fixed Network Equipment	$

Other Project Costs

Order Processing; Manufacturing; Cold Installation Services; Optimization; Antenna Sweeps; Functional ATP; Site, Tower and Rack-face Drawings; Warranty; Freight; Performance Bond	$

Other Project Costs were estimated based on all four sites combined. No Design Review, Staging, Coverage Testing, or Training services are included in this estimate. Additionally, no taxes are included.

NOTE: The information provided in this estimate is for informational (or budgetary) purposes only and does not constitute an offer to sell or license any Motorola product. It is not binding on Motorola and Motorola makes no representations, warranties, or commitments with respect to pricing, products, or terms and conditions, which would require more information and further detailed analysis of the requirements for which this estimate is requested.

OUR COMMITMENT

Motorola products are growing and changing, as they have over the years, and Motorola's drive for excellence has strengthened and intensified. From the five-pound Handie-Talkie™ radio to the lightweight models of today, Motorola has been the leading provider of two-way radio services to public safety, government, transportation, utility, and manufacturing enterprises. Motorola changed the way the world communicates, from the introduction of the DynaTAC cell phone in 1983 to today's sleek handsets and innovative technology for mobile telephone service. Motorola is also a key supplier of integrated systems for automobiles, portable electronic devices, and industrial equipment.

Throughout our history, Motorola has transformed innovative ideas into products that connect people to each other and the world around them. Moving forward, Motorola strives to fulfill our commitment to make products and services better and to make sound recommendations that will guide you in linking your current and future communication needs and objectives with technology's ever-evolving promise.

Upon request, your Motorola Account Executive can provide a firm proposal tailored to meet your total solution needs.

Motorola Confidential Restricted
Use or disclosure of this budgetary proposal is subject to the restrictions on the title page.